VAPOR INTRUSION MITIGATION SYSTEM DESIGN PLAN
4TH AND GAMBELL
ANCHORAGE, ALASKA

APRIL 28, 2014

Prepared For:

Environmental Quality Management, Inc.
18939 120th Avenue NE, Suite 103
Bothell, Washington 98011

Prepared By:

Ahtna Engineering Services, LLC
110 West 38th Avenue, Suite 200A
Anchorage, Alaska 99503

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APPROVAL PAGE

This design plan for constructing vapor intrusion mitigation systems in four residences at the 4th and Gambell site in Anchorage, Alaska has been prepared for the U.S. Environmental Protection Agency, on behalf of Environmental Quality Management, by Ahtna Engineering Services, LLC, with support from their teaming partners Rescon Alaska, LLC and Geosyntec Consultants, Inc.

The following people have reviewed and approved this plan.

Design Plan Prepared By:

Nathan Oberlee
Rescon Alaska, LLC
Environmental Engineer

Design Plan Reviewed By:

Olga Stewart, PE
Ahtna Engineering Services, LLC
Project Manager

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ACRONYMS AND ABBREVIATIONS

AAC .....Alaska Administrative Code
ADEC.....Alaska Department of Environmental Conservation
Ahtna.....Ahtna Engineering Services, LLC
CERCLA.....Comprehensive Environmental Response, Compensation, and Liability Act
COC .....contaminant of concern
DCE.....dichloroethene
E&E.....Ecology and Environment
EPA .....Environmental Protection Agency
EQ .....Environmental Quality Management, Inc.
HEPA .....high-efficiency particulate air
IDW.....investigation-derived waste
in. Hg.....inches of mercury
µg/kg .....microgram per kilogram
µg/L.....microgram per liter
µg/m^3.....microgram per cubic meter
MM&R.....monitoring, maintenance, and repair
NELAP.....National Environmental Laboratory Accreditation Program
OASIS .....OASIS Environmental, Inc.
PA .....preliminary assessment
PCE .....tetrachloroethene
PPE.....personal protective equipment
PVC.....polyvinyl chloride
QA/QC .....quality assurance / quality control
SI.....site inspection
SMD.....sub-membrane depressurization
SOP .....standard operating procedure
TCE.....trichloroethene
TWA .....time-weighted average
VI .....vapor intrusion
VOCs.....volatile organic compounds
WP.....work plan

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1.0 INTRODUCTION

Ahtna Engineering Services, LLC (Ahtna) has developed this Vapor Intrusion Mitigation Design Work Plan (WP) on behalf of Environmental Quality Management, Inc. (EQ) for vapor intrusion mitigation services at four residential structures located within the 4th and Gambell chlorinated solvent release area in Anchorage, Alaska.

1.1 Project Remedial Objectives

The primary objective of this project is to design and install vapor intrusion mitigation systems that reduces contaminant vapors in the buildings below the respective Alaska Department of Environmental (ADEC) target levels for residential indoor air. The secondary project objective is to design systems that are cost effective for both installation and operation, and easy to operate and maintain so that property owners can assist with long-term operations and management.

1.2 Scope of Work

In order to meet the above project objective, Ahtna will execute the following tasks:

- Organize and supervise the safe removal and temporary storage of tenants' belongings until the installation of the mitigation systems is completed.
- Draft a Maintenance, Monitoring and Repair (MM&R) plan (included here) to detail maintenance procedures designed to ensure that the mitigation systems are maintained and sustainable for the duration of time that the structure exists or exposure to the volatile contaminants source is a concern.
- Perform the mitigation system installation, documenting site operations, installation procedures and diagnostic testing.
- Collect indoor air samples at the completion of the installation effort to demonstrate the effectiveness of the mitigation systems.
- Prepare a Final Installation Report documenting field methodologies, analytical results, findings, data gaps and recommendations.
- Update and finalize the MM&R plan, as necessary, and include with submission of the Final Installation Report.

1.3 Regulatory Framework

The regulatory framework for this project was developed using the following regulations and guidance documents:

- Oil and Site Cleanup Rules (18 Alaska Administrative Code [AAC] 75.325 – 18 AAC 75.390)
- ADEC, Vapor Intrusion Guidance for Contaminated Sites, October 2012
- U.S. Environmental Protection Agency (EPA), OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance), November 2002

- EPA, Indoor Air Vapor Intrusion Mitigation Approaches, Engineering Issue, EPA/600/R-08-115, October 2008
- Interstate Technology Regulatory Council, January 2007, Vapor Intrusion Pathway: A Practical Guideline

1.4 Project Schedule

The project schedule for 2014 work at the 4th and Gambell site is presented in Table 1-1. Ahtna will advise EQ if circumstances arise that require schedule adjustment.

TABLE 1-1: PROJECT SCHEDULE

Task	Date
Period of Performance Begins	4/9/14
Notice of Award	4/10/14
Submit Draft Work Plan	4/28/14
Receive Comments	5/1/14
Submit Final Work Plan	5/6/14
Notice to Begin Site Work	5/7/14
Procurement of supplies/contractors	5/6 – 5/11
Moving of occupant's belongings to storage	5/6 – 5/11
Site Work (Radon Testing, Mitigation Installation, Vapor Sampling)	5/12 – 5/23
Submit Draft Installation and Summary Report	6/27/14
Receive Comments	7/4/14
Submit Final Installation and Summary Report	7/11/14
Period of Performance Ends	7/31/14

2.0 SITE DESCRIPTION AND BACKGROUND

The 4th and Gambell site, also known as Alaska Real Estate Parking Lot, is located in downtown Anchorage, Alaska at 717 East 4th Avenue, approximately 1.3 miles east of Cook Inlet's Knik Arm (Figure 1 – Site Vicinity Map). The site is bounded to the north by East 3rd Avenue, to the south by East 4th Avenue, to the west by Gambell Street, and to the east by Hyder Street. The approximate location is latitude 61° 13' 9.3396" north and longitude -149° 52' 13.5732" west within Section 18, Township 13 North, and Range 3 West of the Seward Meridian.

The 4th and Gambell site is comprised of several municipal lots spanning approximately one acre in size. The immediate vicinity is generally flat with an elevation of approximately 110 feet above mean sea level. The surrounding area has a gentle slope to the north towards Ship Creek. Approximately 700 feet to the north of the site the terrain terminates into a bluff that descends sharply towards the Ship Creek drainage 60 to 70 feet below.

2.1 Site Characteristics

The 4th and Gambell site is surrounded by commercial, retail, and residential properties. This project is focused on four residential buildings north of the former dry cleaners facility (Figure 2 – Site Layout Map). For the purposes of previous investigations, this site is divided into Subarea I and Subarea II and are described below.

Subarea I is currently an undeveloped parking lot that was previously occupied by a variety of businesses, including C&K Sanitary Cleaners from 1968 to 1970 and NC Auto Services Center from 1976 to 1978. All of the buildings in Subarea I were removed by 1978. A communications tower/antennae located at the southeast corner of Subarea I is owned by Alaska Communications. The legal description for this one-half city block is Lot 8A, Lot 10, Lot 11, and Lot 12, Block 26A, East Addition. All of these lots are currently owned by the Fourth Avenue Gambell LLC.

Subarea II located immediately north of Subarea I contains single and multi-family residences. The legal description for this one-half city block is Lot 1, Lot 2, Lot 3, Lot 4, Lot 5, and Lot 6A, Block 26A, East Addition. Lots 1, 2, 3, and 4 are owned by (b) (6) and Lots 5 and 6A are owned by (b) (6). East 3rd Avenue and the former Alaska Native Hospital property, which is now vacant, are located to the north beyond the residential buildings. The four properties requiring mitigation are in Subarea II, located at 710 East 3rd Avenue, 720 East 3rd Avenue, and the north and south duplexes at 736 East 3rd Avenue.

The primary contaminants of concern (COCs) for the 4th and Gambell site are tetrachloroethene (PCE) and its degradation products trichloroethene (TCE), dichloroethene (DCE) isomers, and vinyl chloride. The site COCs belong to a category of contaminants known as volatile organic compounds (VOCs) that are considered a hazardous substance or pollutant or contaminant as defined by sections 101(14) and 101(33) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended 42 United States Code § 9601(14) and (33). The likely source of the PCE contamination is presumably the former C&K Sanitary Cleaners in Subarea I. PCE is widely utilized in dry-cleaning processes; environmental releases from spills or improper disposal were common from historical dry-cleaning businesses.

2.2 Previous Investigations

Several environmental investigations have been performed at the site to assess the nature and extent of contamination, to investigate contaminant vapor sources and assess the extent of the vapor intrusion (VI) exposure pathway. The investigations began in 1993. The three most recent and investigations are summarized below.

2011 – E&E Preliminary Assessment

Ecology and Environment, Inc. (E&E) conducted a Preliminary Assessment (PA) on behalf of the EPA in October 2011 (E&E 2011). The PA was based on a review of existing site information, receptor information within the range of the site's influence, and regional characteristics. The PA report discussed the site's history, summarized previous work completed by the ADEC, identified sources of hazardous substances at the site, and summarized field work conducted during the site visit in July 2011. The PA concluded that documentation was clear regarding contamination being present at the site, as well as its migration northeast toward Ship Creek.

2011 – OASIS Site Characterization

OASIS Environmental, Inc. (OASIS) conducted off-site characterization activities at adjacent Block 26B, East Addition Subdivision on behalf of the ADEC during April, May, and November 2011 (OASIS 2012). The investigation included advancing and sampling four soil borings, installing and sampling four existing groundwater monitoring wells, and installing nine soil gas monitoring points. PCE, and its breakdown compounds such as TCE, were not detected in soil samples collected as part of this investigation. Groundwater samples from each borehole were analyzed. PCE was the only VOC detected and was present in only one groundwater sample at 0.24 micrograms per liter (µg/L). Soil gas samples did not indicate the presence of VOCs in soil gas at concentrations greater than their respective ADEC soil gas target levels.

July 2012 – E&E Site Inspection

E&E conducted a Site Inspection (SI) on behalf of the EPA in 2012 (E&E 2013). The SI included surface and subsurface soil sampling, groundwater sampling, sediment sampling, outdoor and indoor air sampling, and passive soil gas sampling. Thirty-one surface soil samples were collected. TCE was detected in one surface soil sample at 11 micrograms per kilogram (µg/kg,) while the highest PCE surface soil concentration was 200 µg/kg. One hundred and twenty-one (121) subsurface soil samples were collected. PCE was detected in 38 of 60 on-site and 16 of 52 off-site subsurface soil samples. The highest on-site PCE concentration was 56,000 µg/kg and the highest off-site concentration was 330 µg/kg. Groundwater samples were collected from six on-site monitoring wells and five off-site monitoring wells. PCE was detected in five of the six on-site samples with PCE concentrations ranging between 7.8 and 1,600 µg/L. Both 1,2-dichloropropane and methylcyclohexane were detected only in one well at 6.4 µg/L and 9.8 µg/L, respectively. PCE was detected in three of the five off-site samples at concentrations ranging between 72 and 8,500 µg/L. TCE was detected in only one sample at 6 µg/L. Nine sediment samples were collected from nearby Ship Creek, and analytical results indicate that no VOCs were detected. One on-site and six off-site outdoor ambient air samples were collected,

and only toluene was detected at a significant concentration (11 micrograms per cubic meter [µg/m^3] in an off-site sample) with respect to background concentrations. Twelve indoor ambient air samples were collected. PCE was only detected in the samples collected from residences in Subarea II of the site, with concentrations ranging from 1.0 to 66 µg/m^3. Nine passive soil gas samples were collected. 1,2,4 Trimethylbenzene and o-xylene were detected in one sample at 1.6 µg/m3 and 1.71 µg/m3, respectively. Chloroform was detected in one sample at 91.35 µg/m^3. The analytes m,p-xylenes and toluene were detected in all samples with concentrations ranging from 1.22 to 2.42 µg/m^3 and 3.83 to 7.01 µg/m^3, respectively. PCE was detected in seven samples ranging from 3.9 to 14.01 µg/m^3.

2.3 Other Actions to Date

The PCE indoor air concentrations in the samples collected from the crawl space locations at the North Duplex and South Duplex in March 2009 exceeded the then current ADEC indoor air target level of 4.1 µg/m^3 (OASIS 2009). The property owner installed a sub-membrane depressurization (SMD) system at each of the duplexes between March and June 2009 to reduce PCE VI into the buildings (OASIS 2010). ADEC continued to monitor the crawl space air at both of these duplex locations during VI sampling events performed in June 2009, February 2010, and May 2010. The June 2009 crawl space results for the South Duplex were less than the ADEC residential indoor air target level but all remaining crawl space sample results from the duplexes have been greater than the ADEC indoor air target level of 4.1 µg/m^3 for PCE. Note that the residential indoor air target level for PCE of 4.1 µg/m^3 was revised in 2012 to 42 µg/m^3 (ADEC 2012).

The June 2009, February 2010, and May 2010 air sample results prompted ADEC and OASIS staff to perform a site inspection of the SMD systems for the North Duplex and South Duplex during November 2010 (OASIS 2010). The North Duplex inspection revealed several penetrations through the membrane liner used to seal the crawl space, and the South Duplex inspection could not be completed due to access restrictions of the crawl space. The inspection report recommended upgrading the SMD systems. However, it is not known whether any improvements were made and/or whether the depressurization systems are operating.

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3.0 BUILDING SPECIFIC SYSTEM DESIGNS

Passive vapor intrusion mitigation systems will be installed at each of the four properties. The specific installation in each building will vary based on the structure. However, the basic principal of mitigation in each building will be the same. Vapor barriers, either coatings or liners, will be used to seal the building from the subsurface. Extraction lines and wells will then be installed to provide a preferential pathway for accumulated vapors below the vapor barrier to be vented through vertical exhaust stacks routed on the exterior of each building.

A general summary of the mitigation system design in each building is described in the following section. Construction and installation specifics for the mitigation system components are further detailed in Section 4.0.

3.1 710 East 3rd Avenue

The 710 East 3rd Avenue house is constructed on a foundation that contains a basement with a concrete slab and a dirt floor crawl space. A combination of a vapor tight concrete coating, passive sub-slab depressurization, and passive SMD will be used to mitigate vapor intrusion of contaminants in the building. The mitigation system layout at 710 East 3rd Avenue is shown on Figure 3.

The mitigation system components that will be installed in the 710 East 3rd Avenue are as follows:

1. Two 2-inch diameter depressurization wells will be centrally located along an interior wall of the basement to remove accumulated vapors from beneath the slab. Each depressurization well will be routed through 2-inch diameter rigid Schedule 80 PVC conveyance piping to a common exhaust line.

2. Migration of contaminants vertically through the concrete slab and laterally through the concrete foundation walls will be mitigated by sealing the surfaces with the vapor intrusion coating system, Retro-Coat™, by Land Science Technologies™. The surfaces where the Retro-Coat™ will be applied are outlined on Figure 3. For this technology to effectively block contaminants, all areas must be sealed. Therefore, the carpet in the north end of the common area will be removed to seal the concrete beneath it.

3. A sub-membrane depressurization system will be installed in the L-shaped crawl space along the north and east sides of the house. Two sections of 4-inch diameter perforated polyvinyl chloride (PVC) piping will be installed on the floor of the crawl space. The perforated PVC will be attached to 4-inch Schedule 80 PVC conveyance piping that will be routed to the common exhaust stack along with the depressurization wells.

4. A 10-mil thick VaporBlock® vapor barrier will be installed along the floor and walls of the crawl space.

5. The conveyance piping from the depressurization wells will be routed to a common 4-inch diameter exhaust stack on the west wall of the house. The SMD conveyance piping will be routed through a separate exhaust stack on the east wall of the house.

3.2 720 East 3rd Avenue

The 720 East 3rd Avenue house was originally constructed on a concrete block foundation and a basement. An addition was added on the north side of the building that is supported by posts. No access or ventilation is present between the basement and the addition crawl space. A combination of a vapor tight concrete coating, passive sub-slab depressurization, and passive crawl space ventilation will be used to mitigate vapor intrusion of contaminants in this structure. The mitigation system layout at 720 East 3rd Avenue is shown on Figure 4.

1. Two depressurization wells will be evenly located in the basement of the house to remove accumulated vapors from beneath the slab. Each depressurization well will be routed through 2-inch diameter rigid Schedule 80 PVC conveyance piping to a common exhaust line.

2. Migration of contaminants vertically through the concrete slab and laterally through the concrete foundation walls will be mitigated by sealing the surfaces with the vapor intrusion coating system, Retro-Coat™, by Land Science Technologies™. The surfaces where the Retro-Coat™ will be applied are outlined on Figure 4. For this technology to effectively block contaminants, all areas must be sealed. Therefore, the carpet on any of the floors will be removed in order to seal the concrete beneath it.

3. The crawl space area on the north end of the building does not pose as great of a risk of vapor intrusion because it is an above-grade addition to the house that is hung from the house on the south side and is supported by posts on the north end. The accumulation of vapors under the addition will be mitigated by installing 6-inch by 12-inch passive vents on both the east and west walls of the crawl space. The additional vents will provide cross-ventilation to promote fresh air exchange.

3.3 736 East 3rd Avenue – North Duplex

The 736 East 3rd Avenue North Duplex is constructed on a foundation that contains a partial basement with a concrete slab and a partial dirt floor crawl space. A combination of a vapor tight concrete coating, passive sub-slab depressurization, and passive SMD will be used to mitigate vapor intrusion of contaminants in the North Duplex. The mitigation system layout in the North Duplex is shown on Figure 5.

The mitigation system components that will be installed in the 736 East 3rd Avenue – North Duplex are as follows:

1. Two 2-inch diameter depressurization wells will be located in the laundry room and workshop area of the basement to remove accumulated vapors from beneath the slab. Each depressurization well will be routed through 2-inch diameter rigid Schedule 80 PVC conveyance piping to a common exhaust line.

2. Migration of contaminants vertically through the concrete slab and laterally through the concrete foundation walls will be mitigated by sealing the surfaces with the vapor intrusion coating system, Retro-Coat™, by Land Science Technologies™. The surfaces where the Retro-Coat™ will be applied are outlined on Figure 5.

3. An SMD system will be installed in the L-shaped crawl space along the north and east sides of the building. Two sections of 4-inch diameter perforated PVC piping will be installed on the floor of the crawl space. The perforated PVC will be attached to 4-inch Schedule 40 PVC conveyance piping. One section of piping will be routed to the common exhaust stack near the northwest corner of the building along with the depressurization wells. The longer section, situated north-south in the crawl space, will be routed to a second exhaust stack that will be located on the east side of the building.

4. The conveyance piping from the depressurization wells and the SMD system will be routed to two, 4-inch diameter exhaust stacks. A wind turbine will be affixed to the top of each exhaust stack.

5. A 10-mil thick VaporBlock® vapor barrier will be installed along the floor of the crawl space, above the perforated PVC collection piping. The vapor barrier will be sealed to the Retro-Coat™ on the perimeter foundation walls using Permalon® liner tape or equivalent.

The North Duplex poses the greatest potential risk from vapor intrusion based on historical sampling results. As a contingency measure, therefore, conveyance and exhaust piping will be situated in locations where a high efficiency radon style fan could be installed in the future if elevated indoor air concentrations persist.

3.4 736 East 3rd Avenue – South Duplex

The 736 East 3rd Avenue – South Duplex is constructed on a crawl space foundation that extends under the entire structure. A passive SMD system will be used to mitigate vapor intrusion of contaminants in the South Duplex. The mitigation system layout at 736 East 3rd Avenue – South Duplex is shown on Figure 6.

1. An SMD system will be installed in the crawl space longitudinally along the east and west sides of the house. Two sections of 4-inch diameter perforated PVC piping will be installed on the floor of the crawl space. The perforated PVC will be attached to 4-inch diameter Schedule 80 PVC conveyance piping that will be routed to two separate exhaust stacks.

2. A 10-mil thick VaporBlock® vapor barrier will be installed along the floor and walls of the crawl space.

3. The conveyance piping from the SMD system will be routed to two separate 4-inch diameter exhaust stacks to promote additional airflow over such a large area.

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4.0 SYSTEM CONSTRUCTION METHODS

The specific construction/installation methods for the individual mitigation system components will be the same in all four buildings. Details of the main system components are listed below.

4.1 Extraction Wells

The sub-slab extraction wells will be located along interior walls, behind doors, or in corners, to minimize disruption to the building owners and to reduce the risk of damage to the piping. Ahtna personnel will install the 2-inch diameter vapor extraction wells using a combination of hand tools and a high-efficiency particulate air (HEPA) vacuum to remove soil cuttings down to a depth of approximately 12-inches below the concrete slab. This installation method is effective for installing wells to the desired depth and reduces fugitive dust in the building.

The extraction wells will be constructed of a 12-inch section of 0.020-inch slot screened interval that will be bedded in 8-12 silica sand. The well riser will be sealed to the concrete slab with a low VOC and vapor tight construction epoxy. Each depressurization well will be routed through 2-inch diameter rigid Schedule 80 PVC conveyance piping to a common exhaust line.

4.2 Retro-Coat Concrete Sealing

Migration of contaminants vertically through the concrete slab and laterally through the concrete foundation walls will be mitigated by sealing the surfaces with the vapor intrusion coating system, Retro-Coat™, by Land Science Technologies™. PetroChem, an installer that is trained and certified by the manufacturer, will prepare the surfaces and will apply the Retro-Coat™.

Retro-Coat™ is a traffic-bearing surface and does not require that a protective material be placed over it. The Retro-Coat™ product comes in a variety of colors. Prior to sealing, the installers will prep the surfaces by patching/sealing any major cracks and around utilities with an epoxy grout, grinding the floor to a concrete surface profile CSP-3 smoothness, thoroughly cleaning all surfaces, sealing any cracks or penetrations with a vapor tight caulk, and applying a primer that ensures proper adhesion of the Retro-Coat. Additional information on the Retro-Coat™ product is included in Appendix A.

4.3 Crawl Space Vapor Barriers

A 10-mil thick VaporBlock® vapor barrier will be installed along the floor and walls of the crawl spaces, above the perforated PVC collection piping. The vapor barrier will be installed with as few seams as possible. Any seams that are necessary will be sealed using a 4-inch wide vapor barrier tape specified by the manufacturer. The vapor barrier will be sealed to either the Retro-Coat™ on the perimeter foundation walls or the sill plate at the top of the foundation wall (depending on the building), and to any posts or structures, using Permalon® liner tape or equivalent. Additional information on the VaporBlock® liner is included in Appendix A.

4.4 Conveyance Piping and Exhaust Stacks

Conveyance piping from the extraction wells will be constructed of 2-inch diameter Schedule 80 PVC piping. Conveyance piping from the perforated SMD piping will be constructed of 4-inch diameter Schedule 80 PVC piping. The conveyance piping will be routed in the shortest, most direct routes possible to reduce head loss in the pipe. The conveyance piping will be routed along walls or on the ceiling to minimize the disturbance to building occupants. The piping will be hung from the walls and ceiling using Unistrut and Unistrut clamps.

The building exhaust stacks will be routed vertically up the side of each building and will be constructed of 4-inch diameter, Schedule 80 PVC piping. The stacks will be connected to the side of the buildings using Unistrut and Unistrut clamps. The exhaust stacks will extend a minimum of 2-feet above the peak of the building to reduce the risk of backdraft. A wind turbine will be affixed to the top of each stack to promote air-flow during wind events.

5.0 SAMPLING AND ANALYSIS PLAN (SAP)

Prior to and after the installation of the passive mitigation systems, Ahtna will perform indoor air monitoring to assess the efficacy of the systems in reducing the vapor intrusion exposure to the buildings. The indoor air monitoring will consist of collection of pre- and post-installation samples for radon and post-installation samples for the site-specific COCs.

5.1 Sample Locations

The indoor air samples will be collected from the basements or crawlspaces of each of the four buildings in centrally located areas that have minimal influence from potential area with increased air exchange (e.g., near a door or window).

5.2 Radon Testing

Operational system parameters (i.e., vacuum influence, flow) cannot be measured in passive SSD and SMD systems because of the low flow and low vacuum produced within the extraction lines. In lieu of these operational parameters, pre-installation and post-installation radon levels in the indoor air of the basements and crawlspaces will be tested. Background radon is present in the soil across the United States and is usually detectable at varying levels in indoor air. The pre-installation samples will provide a baseline concentration for comparison with the post system installation levels. A steady or lower radon concentration for post-installation is evidence that the passive mitigation systems are effective.

Ahtna will collect radon samples in 0.5-liter Tedlar bags using a dedicated syringe for each sample in accordance with the EPA Grab Radon / Pump-Collapsible Bag method (EPA, 1996). The samples will be drawn from the ambient air at each sample location using 100 ml syringes. Five draws will be collected at each location to fill the 0.5-liter Tedlar bags.

The samplers will be sent to the laboratory at the Department of Earth Sciences, University of Southern California, Los Angeles, California, for analysis of radon. Analysis will occur using alpha scintillation counting in accordance with the standard operating procedure (SOP) provided in Appendix B.

5.3 Post-Installation Indoor Air Monitoring

The post-installation indoor air monitoring for COCs will be conducted in accordance with the screening and sampling procedures outlined in the ADEC Vapor Intrusion Guidance and the ADEC SOP, which is attached in Appendix B. One indoor air sample will be collected over a 24-hour indoor period in the basement or crawlspace of each building.

Analytical results from the indoor air samples will be compared to the ADEC Target Levels for Residential Indoor Air as listed in the ADEC Vapor Intrusion Guidance for Contaminated Sites. Table 4-1 lists the cleanup levels for the COCs.

TABLE 5-1: ADEC TARGET LEVELS FOR RESIDENTIAL INDOOR AIR

Contaminant	Cleanup Level (µg/m^3)
PCE	42
TCE	2.0
cDCE	7.3
tDCE	63
1,1-DCE	210
VC	1.6

Key:

µg/m^3	micrograms per cubic meter
PCE	tetrachloroethylene
TCE	trichloroethylene
cDCE	cis-1,2-dichloroethylene
tDCE	trans-1,2-dichloroethylene
1,1-DCE	1,1-dichloroethene
VC	vinyl chloride

The samples will be collected in 100%-certified, 6-liter stainless steel Summa canisters to ensure the data is representative of the daily conditions in the buildings. ALS Environmental of Simi Valley, California, will provide the sampling hardware and analyze the samples by EPA Method TO-15. The sample canisters will be fitted with individual flow controllers to provide a 24-hour time-weighted average (TWA) concentration. To ensure a representative sample collection, Ahtna will perform the following actions prior to sampling:

- Contact the laboratory subcontractor to ensure the canister sample size is sufficient to obtain the desired reporting limit.
- Utilize Summa canisters for the collection of air samples.
- Ensure the laboratory-supplied flow controllers include vacuum gauges and particulate air filters.
- Minimize sampling error by avoiding actions that could cause sample interference such as: fueling vehicles, using permanent ink marking pens, or wearing perfume or cologne in vicinity of the samples.
- Measure the initial vacuum of the canister. Any canister containing an initial vacuum of less than 25 inches of mercury (in. Hg) will not be utilized and will be replaced during the sampling event.

After placement of the canisters at the sample locations, Ahtna will perform a leak detection test on the canister and flow controller connection to ensure an accurate sample collection. The procedures of the leak detection test will be performed as follows:

1. Ensure the canister valve is closed.
2. Attach the flow controller assembly (consisting of the flow controller, the particulate filter and the vacuum gauge) to the canister and place the brass cap at the end of the flow controller.
3. Open the valve briefly a half-turn, then close. Verify for one minute that the vacuum holds. If the needle on the vacuum gauge drops, then refit or tighten connections until the needle holds stead for one minute.

4. Remove the brass cap and open the valve a half-turn to begin the sample collection period.
5. Record the start time, date, initial vacuum, regulator serial number and canister ID on the canister tag, the field notes and the laboratory chain of custody form.
6. Monitor sample progress periodically.
7. Sampling personnel will avoid lingering in the immediate area of the sampling device while samples are being collected to avoid undue influence from sampling.
8. At the completion of the 24-hour sampling period, close the valve on the canister, hand-tight.
9. The canisters will be retrieved prior to being completely filled to enable comparison of the residual vacuum level at the end of the sample collection with the vacuum measured upon receipt to the lab for quality control purposes.
10. Record the final vacuum on the canister tag, field notes and chain of custody form.
11. Submit the samples to the analytical laboratory in accordance with chain of custody procedures.

A duplicate sample will be collected from the north duplex structure at 736 East 3rd Avenue, the building with the historically highest indoor air concentrations. The post-installation radon samples will be collected in accordance with the procedures outlined in Section 5.1.

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6.0 QUALITY ASSURANCE PROJECT PLAN (QAPP)

6.1 Personnel

This project will be managed by Olga Stewart, PE. Mr. Nate Oberlee of Rescon Alaska LLC (Rescon) will serve as the project engineer. His duties will include development of the mitigation system designs and leading the field installation. Ben Martich of Geosyntec Consultants (Geosyntec) will lead the indoor air sampling effort and will analyze the collected data. All individuals meet the definition of "qualified person" per 18 AAC 75.990(100). The organizational structure of the project team is listed Table 6-1.

TABLE 6-1: PERSONNEL

Person	Firm	Responsibility
Olga Stewart	Ahtna	Project Manager, Health and Safety oversight
Nate Oberlee	Rescon Alaska	Project Engineer, Field team lead
Ben Martich	Geosyntec	Indoor air sampling
Zack Kirk	Rescon Alaska	Field team support, document preparation
Zach Rasmussen	Ahtna	Field team support
Emily Freitas	Ahtna	Project chemist, data review
Kelly Horiuchi	ALS Laboratory	Laboratory services – PCE, TCE, DCE, VC
Doug Hammond	Earth Sciences	Laboratory services – Radon

6.2 Field Procedures

All fieldwork and laboratory analyses will be conducted in accordance with 18 AAC 75 and associated ADEC guidance manuals. Field personnel will collect samples in a manner that preserves the integrity of the sample matrix. Samplers will use dedicated personal protective equipment to prevent cross-contamination between samples. Sampling supplies will be dedicated to each sample location. Sample matrices will have minimal disturbance prior to collection. Sample containers will be sealed and labeled immediately following collection.

6.2.1 Equipment

All monitoring equipment will be calibrated, maintained and operated according to manufacturer recommendations. Field documentation will consist of the use of field logs, sample identification labels and photographs. A field notebook will be maintained to record a description of field activities and samples collected. Corrections will be struck, initialed, and dated.

New, dedicated Tedlar bags and syringes will be used for the radon samples. Each Summa canister and flow controller will be pre-cleaned and individually certified. Field sample quality assurance and quality control (QA/QC) will be verified by sampling handling procedures including chain of custody, holding times, and final vacuums.

6.2.2 Sample Handling

Samples will be tracked by use of chain of custody laboratory forms. Each sample will be individually identified on a chain of custody form. These forms will include sample identification number, sample date, sample time, requested analysis, type and number of sample containers, quality control information, and requested analytical turnaround time. Each form will be signed and dated upon relinquishment to another party, whether shipper, courier, or laboratory, to maintain custody of the samples.

6.2.3 Field Documentation

A written record of all field activities will be kept in a field logbook. All entries will be legible, be written in waterproof ink, and contain accurate and inclusive documentation of the field activities. Errors or changes will be noted using a single line to cross out the entry and will be dated and initialed. The logbook will be maintained as part of the permanent record for the site. All field logbook entries will be dated and signed. Activities and observations to be noted in the logbook include the following:

- Name of author and date and time of entry
- Names and affiliations of personnel on-site
- Location of activity and site conditions
- Field observations and comments
- Documentation of instrument calibration
- Weather conditions
- Rationale for sampling locations and for any changes to sampling protocol
- Locations of site photographs
- Site sketches
- Health and safety comments

Sample numbers will use the following format:

14-4&G-101-IA

Where "14" represents the year; "4&G" represents "4th and Gambell"; "101" is a sequential sample number per calendar year; and "IA" is the designator "indoor air".

6.2.4 Decontamination

Only dedicated or disposable sampling and personal protective equipment (PPE) will be used for field activities. Each 24-hour flow controller is assigned to an individual canister to prevent cross contamination. Decontamination of the canisters and flow controllers will be performed by the laboratory.

6.3 Analytical Program

6.3.1 Analytical Methods

Ahtna will ship the Summa canister samples to ALS Environmental, a National Environmental Laboratory Accreditation Program (NELAP)-approved laboratory, of Simi Valley, California, for analysis of samples by EPA TO-15.

Analysis of the samples will be performed in accordance with approved methods and procedures as outlined in ADEC's Environmental Laboratory Data and Quality Assurance Requirements Technical Memorandum (March 2009). The analytical reporting limits will be less than the residential target air levels in soil gas and indoor air for the COCs. All analyses will occur on a standard 10-day turnaround time.

TABLE 6-2: ANALYTICAL METHODS, CONTAINERS, PRESERVATION, AND HOLD TIME

Compounds		Analytical Method	Sample Container	Preservation	Holding Time
PCE, TCE, cDCE, tDCE, VC		TO-15	6-liter stainless steel can, 100%-certified	None	30 days
Radon		SOP per D. Hammond	0.5-liter	None	10 days

6.3.2 Control Samples

Field quality control checks will include duplicate samples collected at a frequency of 10% per method and matrix. The duplicate sample for TO-15 to be collected in the North Duplex, the location historically with the highest concentrations of COCs. Laboratory quality control checks will include method blanks, laboratory control samples, surrogate spikes, and matrix spikes/matrix spike duplicates.

6.4 Data Review

Analytical data quality will be assessed based on six data quality indicators: completeness, accuracy, precision, comparability, representativeness, and sensitivity. The indicators are listed in Table 6-2 with a summary of the goals.

TABLE 6-3: DATA QUALITY INDICATORS AND GOALS

Quality Indicator	Goal
Completeness	100% of all samples collected are analyzed.
Accuracy	Surrogate % recoveries are within laboratory limits
Precision	Relative percent differences (RPD) ≤ 25%
Comparability	All samples analyzed by the same method in the laboratory
Representativeness	All samples are time-integrated and leak-checked
Sensitivity	All method reporting limits are less than the target levels.

Laboratory performance and analytical results will be checked through a quality assurance review, which will include ADEC's Laboratory Data Review Checklists. The following parameters will be assessed to evaluate data quality indicators.

- Holding times
- Initial and continuing calibration
- Laboratory blanks
- Field and laboratory duplicates
- Surrogates
- Laboratory control samples
- Detection and quantitation limits

Data that do not meet the EPA Functional Guideline requirements will be flagged appropriately and discussed in the quality review report.

7.0 WASTE MANAGEMENT PLAN (WMP)

The investigation-derived waste (IDW) generated during the effort is expected to include soil cuttings from the installation of the depressurization wells at the site and various PPE materials utilized during the remedial effort. Based on site-specific knowledge of the extent of the release, it is not anticipated that the soil removed during the installation of the wells will have been in direct contact with the PCE product. With prior EPA approval, the soil removed during the SSD well installation will be placed with the soil in the crawl space of the same building. No soil will be removed from any of the buildings or transferred between buildings.

The remaining IDW, including disposable sample gloves, paper towels, dust masks, scrap liner material and various other waste generated during the effort will be bagged and taped shut and placed in a solid waste receptacle for disposal at the Anchorage Municipal Landfill.

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8.0 DRAFT MONITORING, MAINTENANCE AND REPAIR PLAN

Due to the passive nature of all four mitigation systems, Maintenance, Monitoring and Repair (MM&R) is minimal. Below is a list of MM&R tasks and the frequency with which each should be performed.

1. Retro-Coat™: Land Science Technologies™ recommends the Retro-Coat™ applicator be contracted to provide annual inspections of the coating. Inspections should be conducted as needed and as long as Retro-Coat™ is expected to eliminate vapor intrusion. Repairs should be performed based on inspection results.

2. VaporBlock®: The crawl space vapor barriers should be inspected annually for tears or punctures. All seams should be inspected to ensure no gaps are present and that the seam tape remains properly adhered to the membrane. The membrane should also be inspected where it is attached to the foundation walls or to the sill plate to ensure the seal remains intact.

3. Wind Turbines: The wind turbines should be inspected annually to ensure proper operation. The turbine should spin freely and should not have excessive play or wobble. The frequency of inspection should be increased if the wind turbines are not spinning during a wind event or if excessive noise or vibration is present when the turbine is in operation.

4. Indoor air monitoring: Indoor air monitoring should occur annually in each building to ensure contaminant concentrations remain below target levels. The amount and/or frequency of the sampling could potentially be reduced if levels consistently remain below target levels.

This Draft MM&R plan will be finalized based on as-built site conditions and will be included with the final report.

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9.0 REPORTING

Ahtna will prepare a Draft Installation Report / Project Summary that encompasses all elements of the scope of work. The report will include the following:

- Introduction and background with details for project objectives, scope of work, and regulatory framework;
- Description of field activities, including management of waste and any deviations from the work plan;
- Description of mitigation systems with drawings showing configuration of the systems;
- Presentation of radon data as a line of evidence to confirm system operation;
- Presentation of air results and findings in narrative, tables, and figures, including comparison of indoor air data to residential target indoor air levels;
- Written quality assurance review of field and analytical protocols and ADEC Laboratory Data Review Checklists;
- Conclusions and proposed recommendations;
- Appendices, including analytical data reports and chains-of-custodies, field notes, imagery; and
- The draft MM&R plan will be updated and finalized based on the as-built system parameters.

We will submit a draft report to EQM in digital format for review. Following receipt of comments from EPA, Ahtna will finalize the report and submit hardcopies and electronic copy on clearly labeled CDs as requested.

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10.0 REFERENCES

Ecology and Environment (E&E), 2013. *Fourth Avenue and Gambell Parking Lot Site Inspection, Anchorage, Alaska*, Contract Number EP-S7-06-02, Technical Direction Document Number 12-01-0004. February.

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OASIS, 2010. *Draft Copy of Additional Site Characterization, 4th and Gambell Site*, Anchorage, Alaska. December.

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FIGURES

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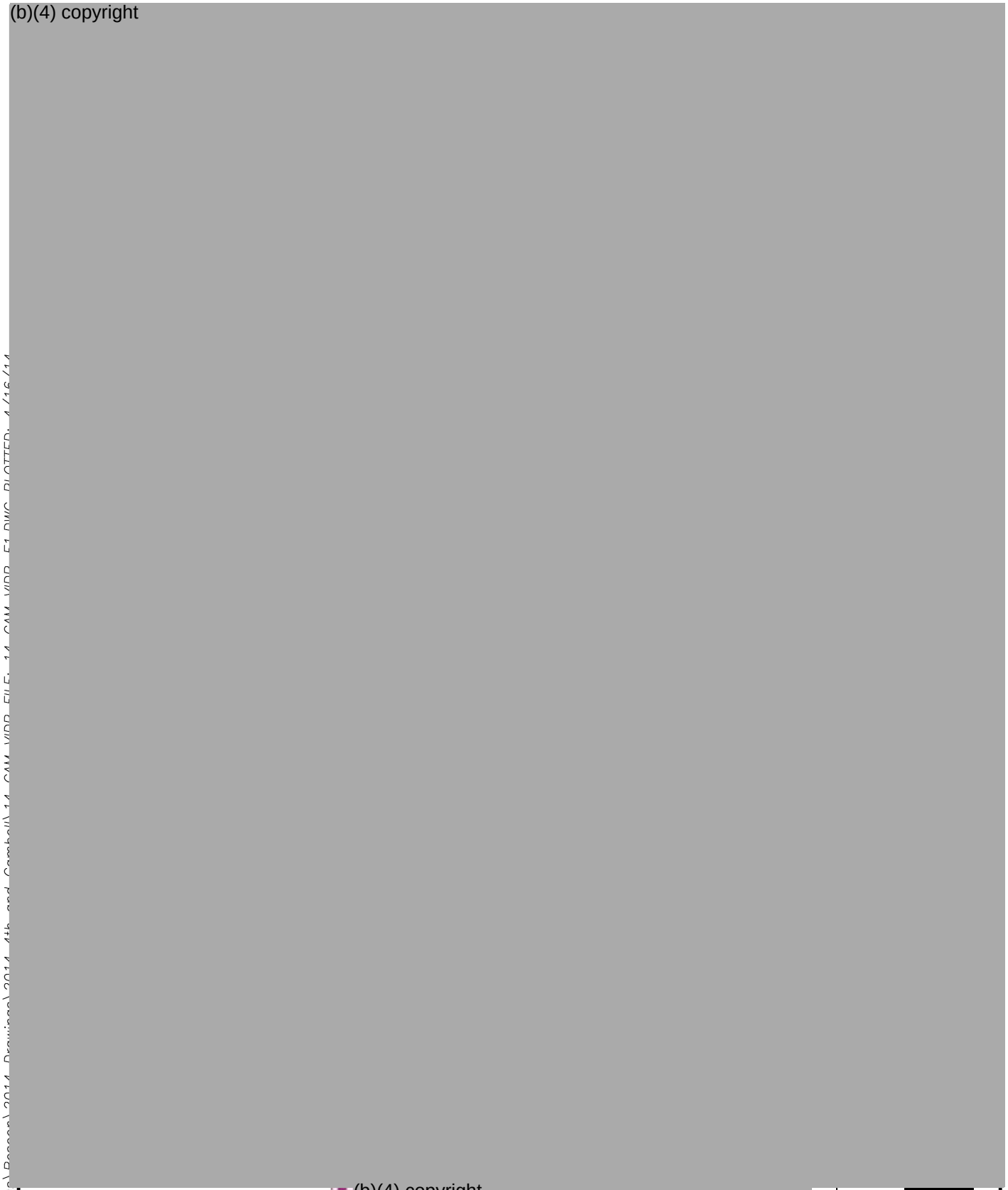

SOURCE: NATIONAL GEOGRAPHIC TOPO SOFTWARE PROGRAM 2010..

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DATE: APRIL 2014
REV.: –
CHKD: N.P.O.
DRAWN: C.E.H.
PROJ. No.: 15-001

Ahtna Engineering

SITE LOCATION MAP

VAPOR INTRUSION MITIGATION DESIGN PLAN
EPA EMERGENCY AND RAPID RESPONSE SERVICES
4TH AND GAMBELL SITE
Anchorage, Alaska

FIGURE
1

PATH: D:\Project Drawings\Recent\2014 Drawings\2014 4th and Gambell\14 CAM VIDP FIG 14 CAM VIDP F1.DWG PLOTTED: 4/16/14

SOURCE: AERIAL PHOTO PROVIDED BY GOOGLE EARTH DATED 4/2011.

APPROX. SCALE IN FEET

DATE: APRIL 2014
REV.: –
CHKD: N.P.O.
DRAWN: C.E.H.
PROJ. No.: 15-001

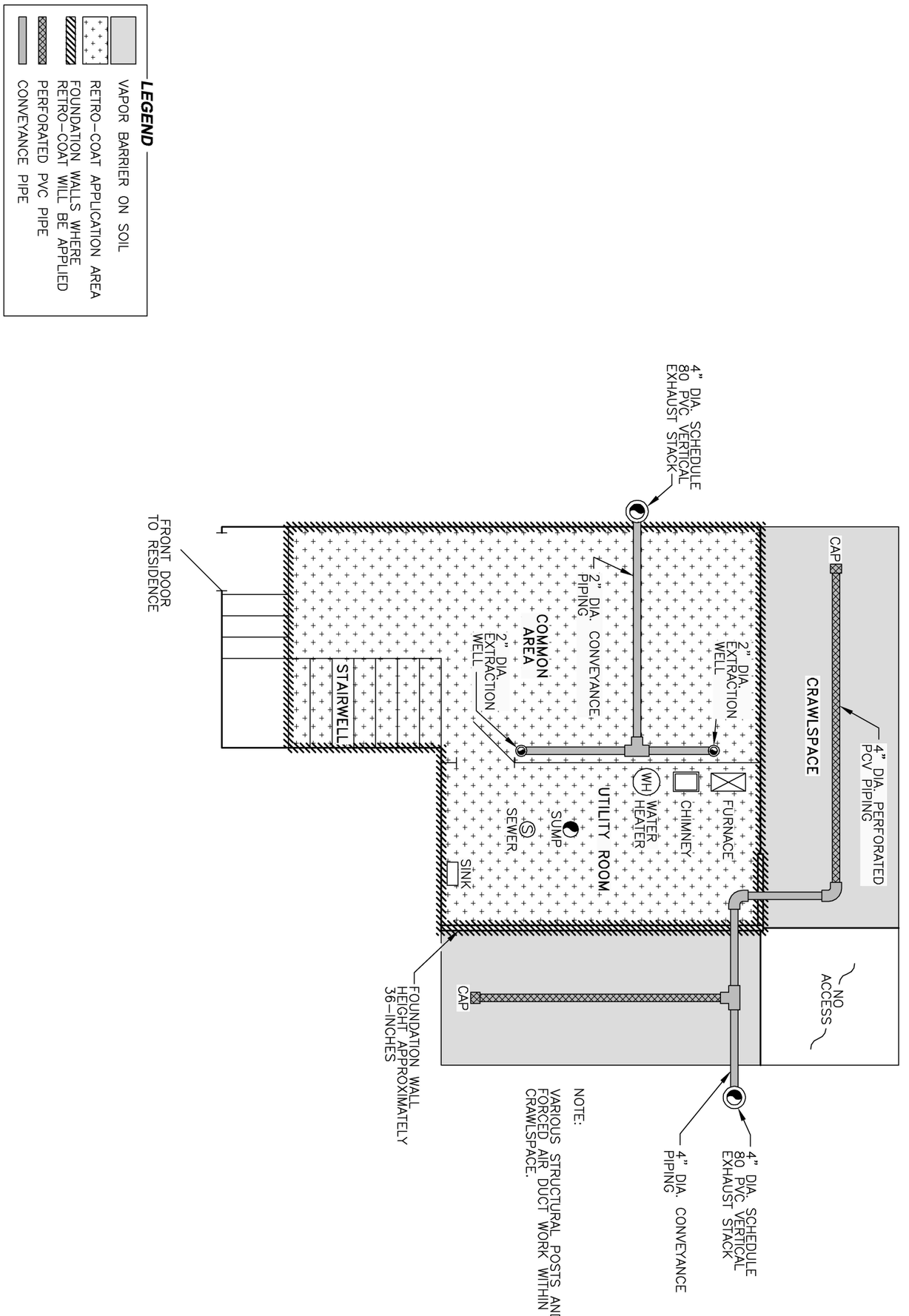
Ahtna Engineering

SITE PLAN

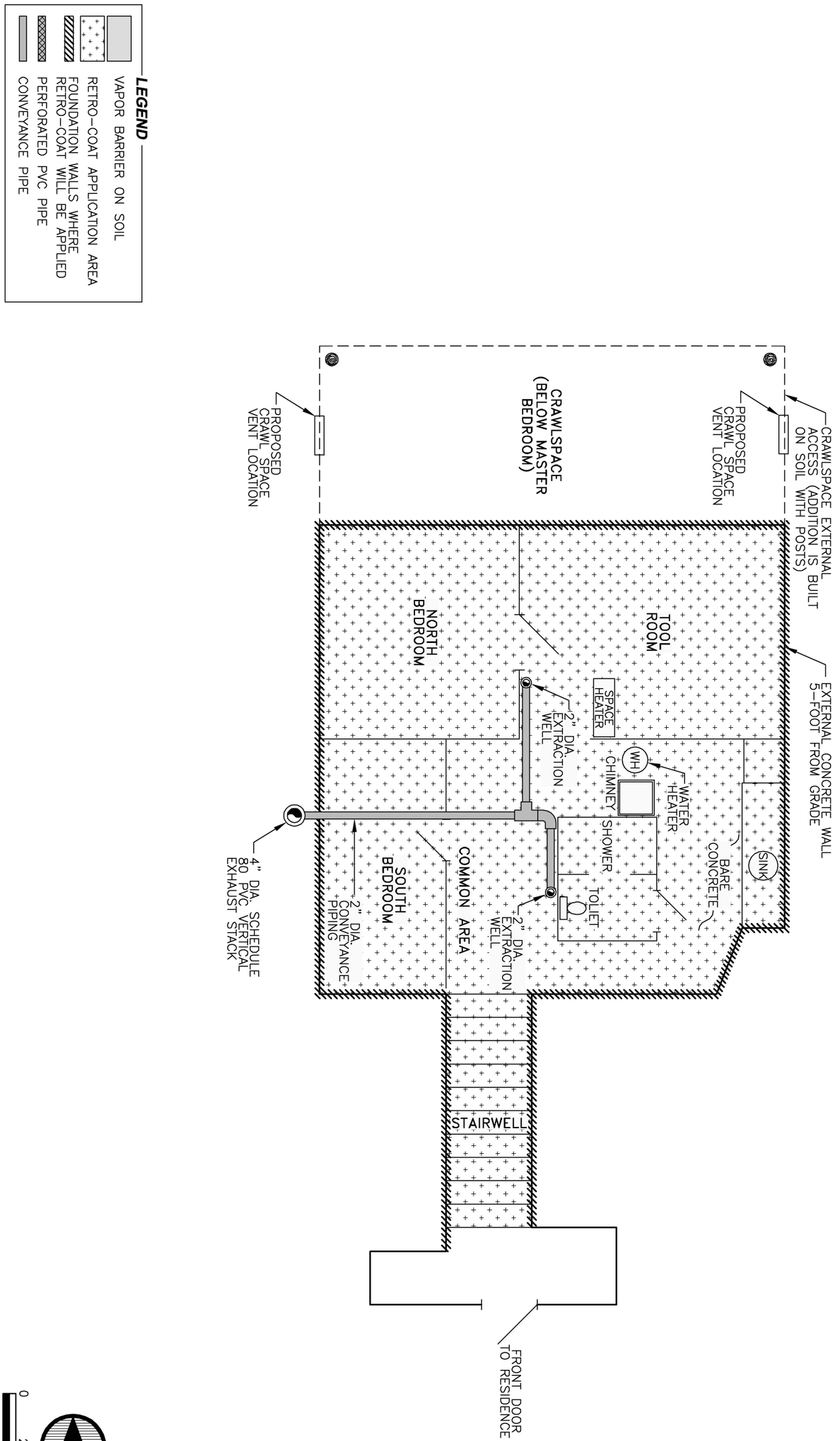
VAPOR INTRUSION MITIGATION DESIGN PLAN
EPA EMERGENCY AND RAPID RESPONSE SERVICES
4TH AND GAMBELL SITE
Anchorage, Alaska

FIGURE

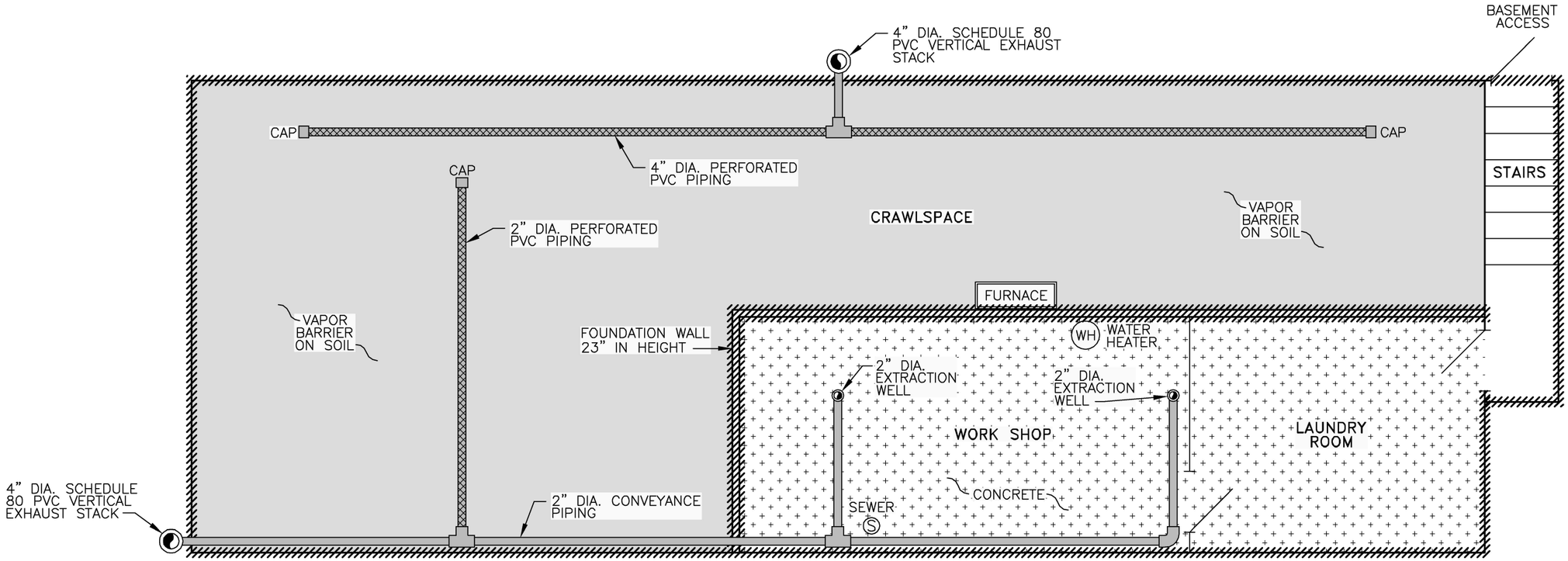
2



DATE: APRIL 2014 REV.: - CHKD: N.P.O. DRAWN: C.E.H. PROJ. No.: 15-001	Ahtna Engineering	**710 E. 3rd AVENUE** VAPOR INTRUSION MITIGATION DESIGN PLAN EPA EMERGENCY AND RAPID RESPONSE SERVICES 4TH AND GAMBELL SITE Anchorage, Alaska	**FIGURE** **3**



DATE: APRIL 2014 REV.: - CHKD: N.P.O. DRAWN: C.E.H. PROJ. No.: 15-001	Ahtna Engineering	**720 E. 3rd AVENUE** VAPOR INTRUSION MITIGATION DESIGN PLAN EPA EMERGENCY AND RAPID RESPONSE SERVICES 4TH AND GAMBELL SITE Anchorage, Alaska	**FIGURE** **4**



LEGEND

- VAPOR BARRIER ON SOIL
- RETRO-COAT APPLICATION AREA
- FOUNDATION WALLS WHERE RETRO-COAT WILL BE APPLIED
- PERFORATED PVC PIPE
- CONVEYANCE PIPE

N

0 2.5 5

APPROX. SCALE IN FEET

FIGURE 5

736 E. 3rd AVENUE (NORTH DUPLEX)

VAPOR INTRUSION MITIGATION DESIGN PLAN
EPA EMERGENCY AND RAPID RESPONSE SERVICES
4TH AND GAMBELL SITE
Anchorage, Alaska

Ahtna Engineering

DATE: APRIL 2014
REV.: –
CHKD: N.P.O.
DRAWN: C.E.H.
PROJ. No.: 15-001

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LEGEND

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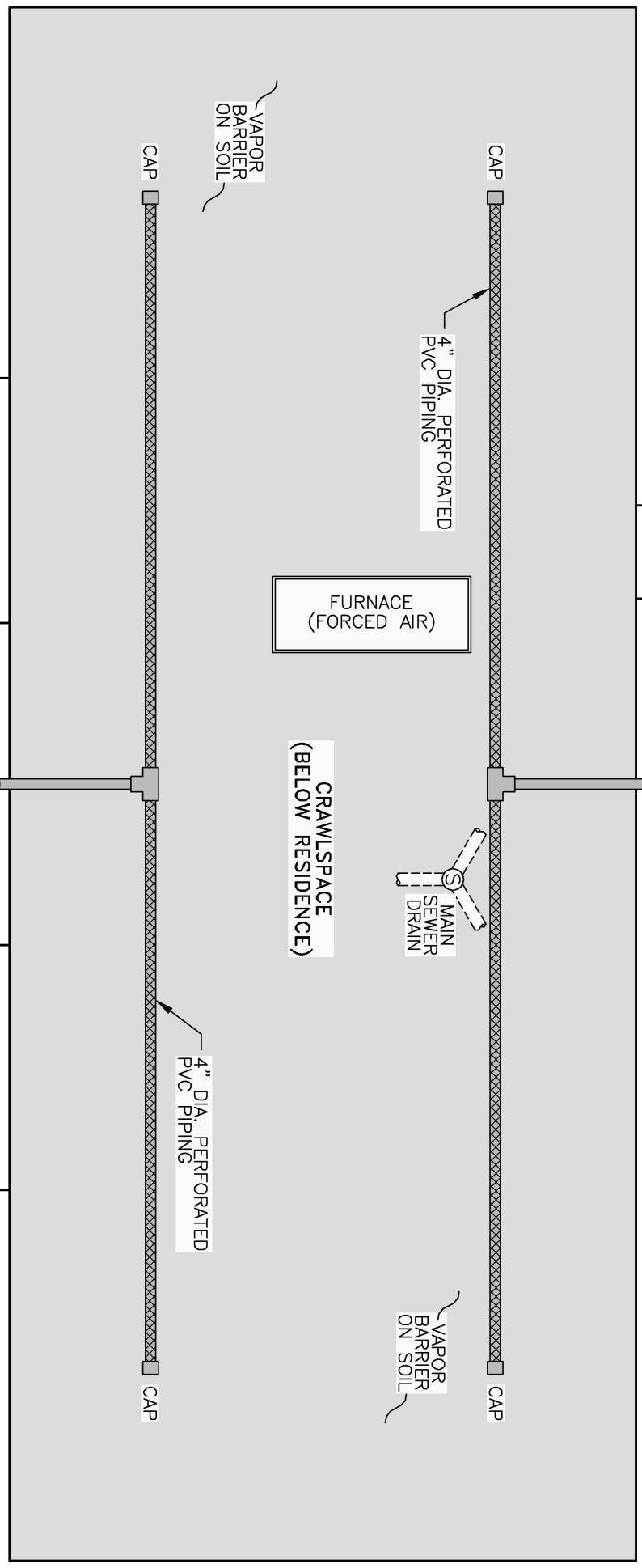
- RETRO-COAT APPLICATION AREA FOUNDATION WALLS WHERE RETRO-COAT WILL BE APPLIED
- PERFORATED PVC PIPE
- CONVEYANCE PIPE



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DATE: APRIL 2014 REV.: - CHKD: N.P.O. DRAWN: C.E.H. PROJ. No.: 15-001	Ahtna Engineering	**736 E. 3rd AVENUE (SOUTH DUPLEX)** VAPOR INTRUSION MITIGATION DESIGN PLAN EPA EMERGENCY AND RAPID RESPONSE SERVICES 4TH AND GAMBELL SITE Anchorage, Alaska	**FIGURE** **6**

APPENDIX A

SYSTEM COMPONENT CUT SHEETS

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Vapor Intrusion Coating System for Existing Structures

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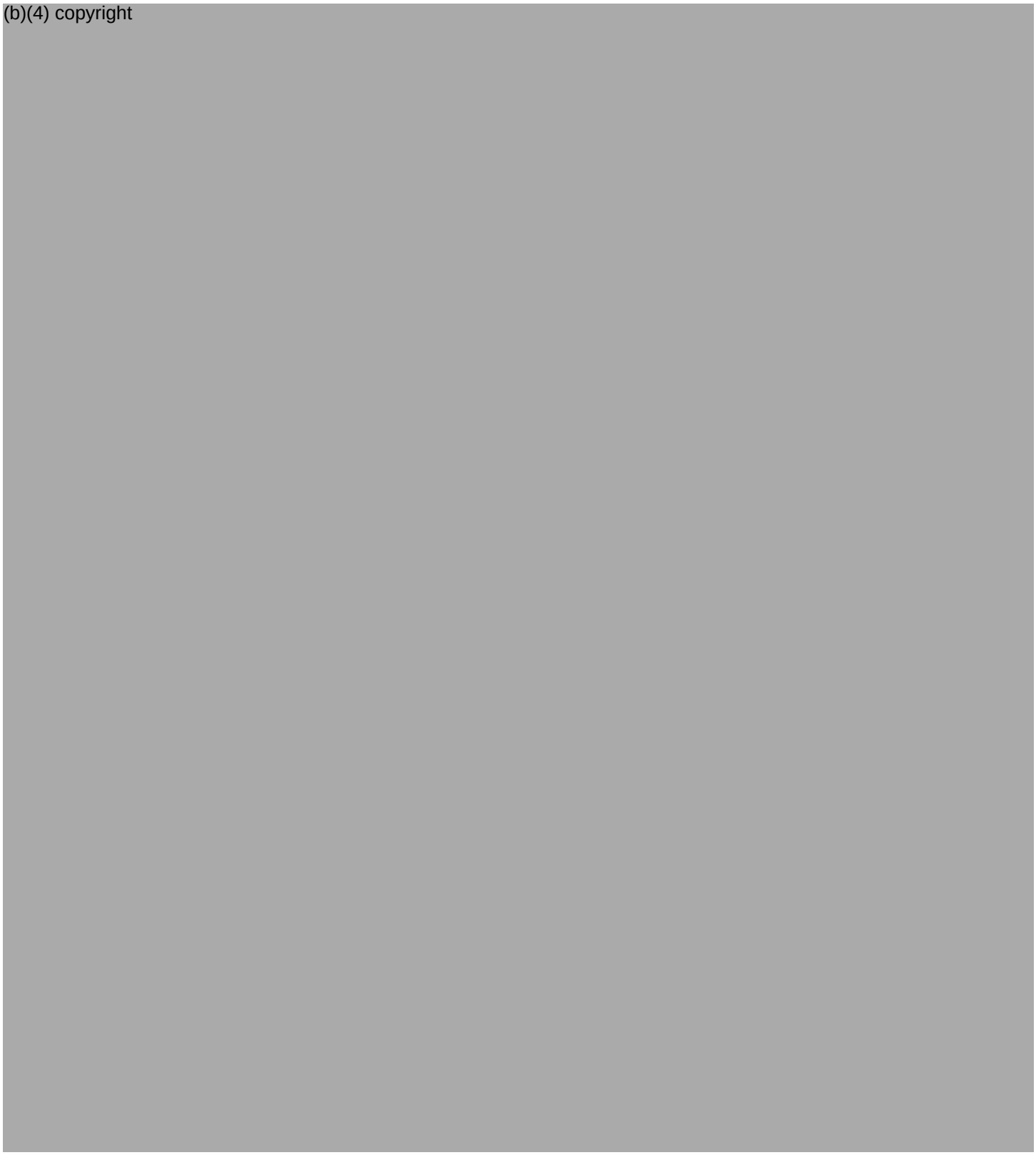

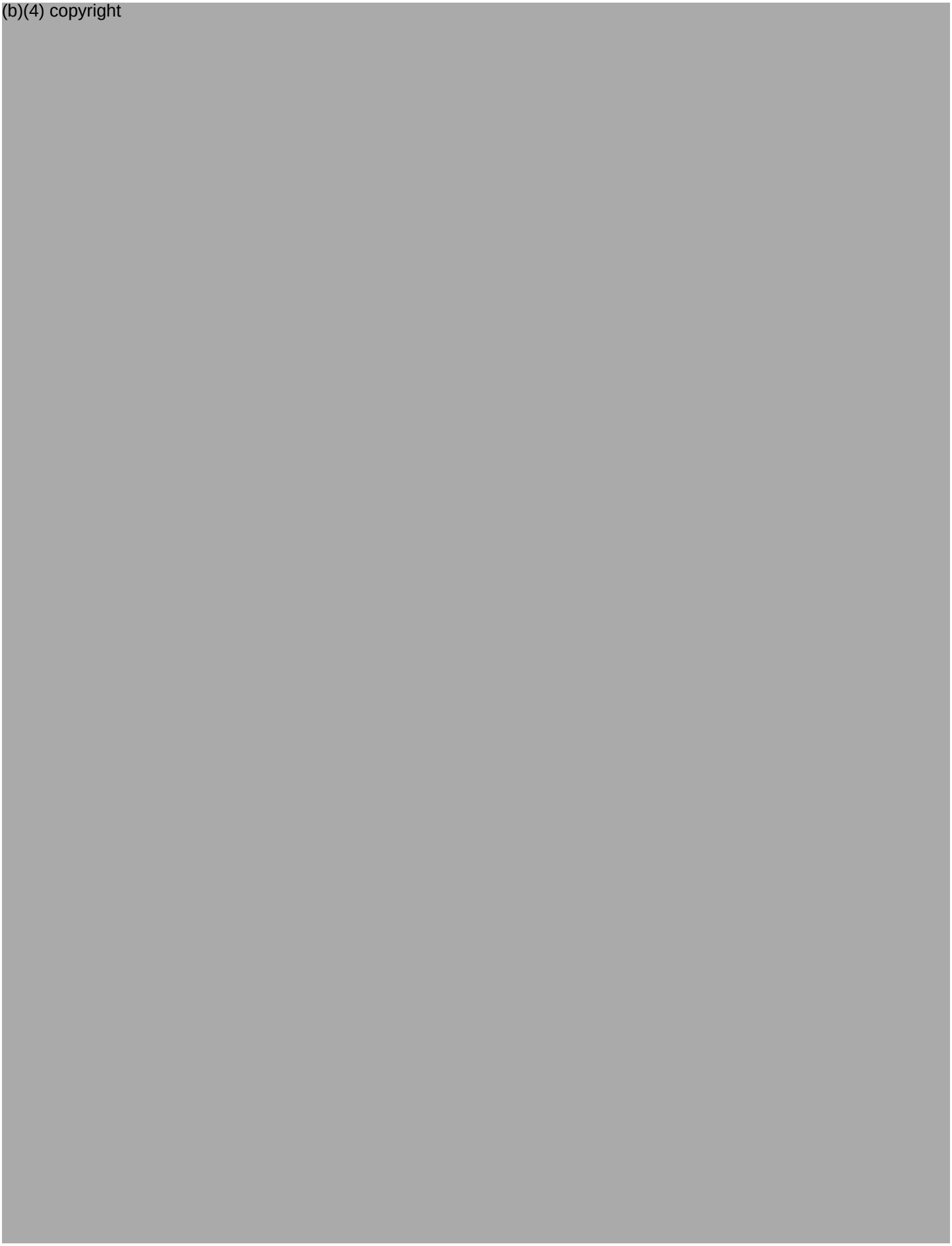

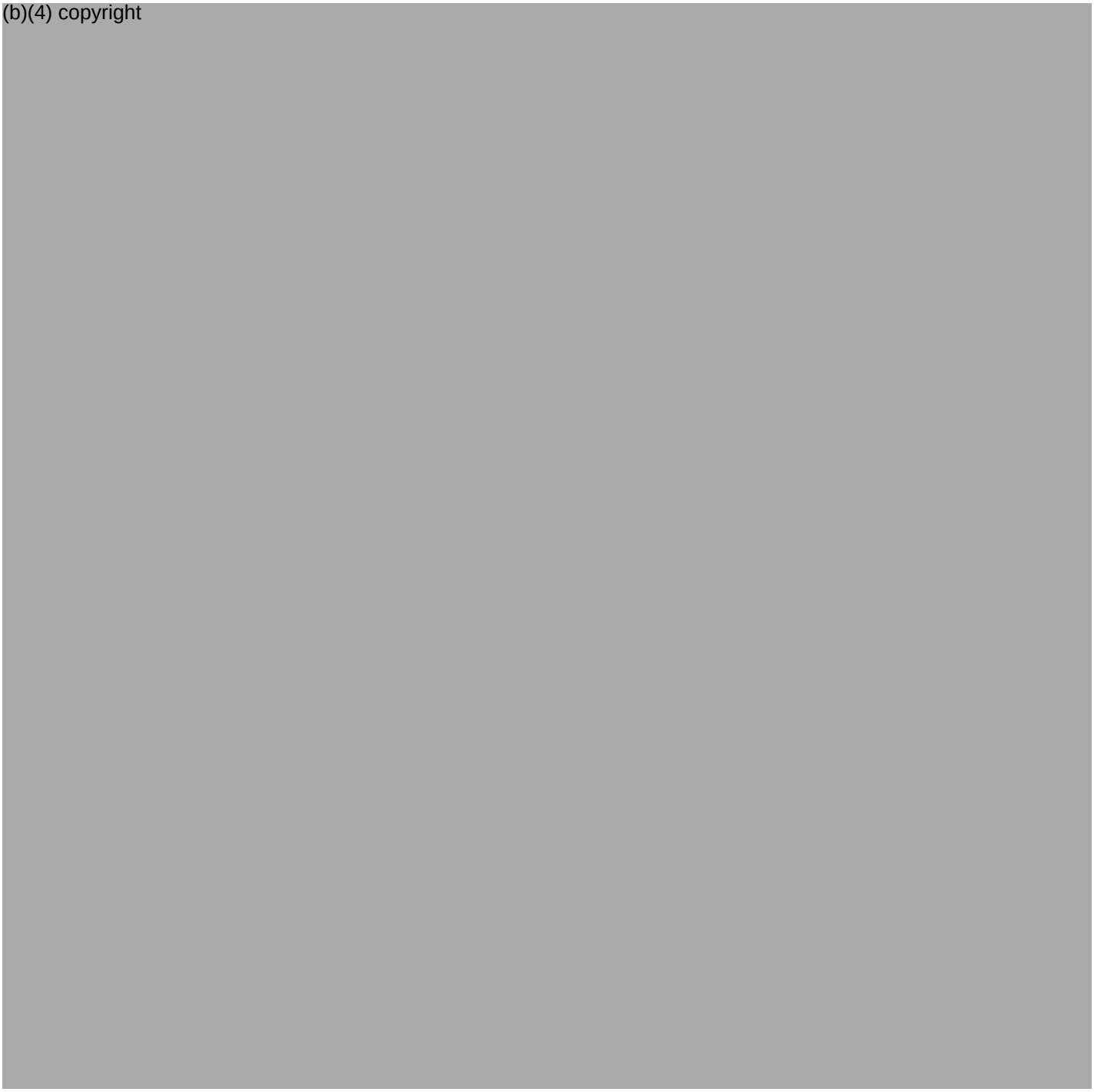

The data, statements and recommendations set forth in this product information sheet are based on testing, research and other development work which has been carefully conducted by Land Science Technologies, and we believe such data, statements and recommendations will serve as reliable guidelines. However, this product is subject to numerable uses under varying conditions over which we have no control, and accordingly, we do NOT warrant that this product is suitable for any particular use. Users are advised to test the product in advance to make certain it is suitable for their particular production conditions and particular use or uses.

WARRANTY – All products manufactured by us are warranted to be first class material and free from defects in material and workmanship.

Liability under this warranty is limited to the net purchase price of any such products proven defective or, at our option, to the repair or replacement of said products upon their return to us transportation prepaid. All claims hereunder on defective products must be made in writing within 30 days after the receipt of such products in your plant and prior to further processing or combining with other materials and products. WE MAKE NO WARRANTY, EXPRESS OR IMPLIED, AS TO THE SUITABILITY OF ANY OF OUR PRODUCTS FOR ANY PARTICULAR USE, AND WE SHALL NOT BE SUBJECT TO LIABILITY FROM ANY DAMAGES RESULTING FROM THEIR USE IN OPERATIONS NOT UNDER OUR DIRECT CONTROL.

THIS WARRANTY IS EXCLUSIVE OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, AND NO REPRESENTATIVE OF OURS OR ANY OTHER PERSON IS AUTHORIZED TO ASSUME FOR US ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OF OUR PRODUCTS.

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VAPORBLOCK® VB6, VB10 & VB15

High Performance Underslab Vapor Barrier

RAVEN INDUSTRIES

Product Description

VaporBlock® is a high performance underslab vapor barrier designed to retard moisture migration through concrete slabs-on-grade. This product is made from state-of-the-art polyethylene resins that provide superior physical and performance properties that far exceed ASTM E-1745 (Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs) Class A, B and C requirements.

High tensile strength, unequaled puncture resistance, ultra low moisture vapor permeability as well as resistance to decay make VaporBlock® one of the most effective underslab vapor barriers on the market today! Available in 6,10 and 15 mil thicknesses to best meet required performance specifications.

Product Use

VaporBlock® impedes the transmission of water vapor from traveling upward through a concrete slab-on-grade or through a concrete wall when properly installed. It is extremely important to avoid puncturing a vapor retarder during installation to assure proper performance. VaporBlock's puncture strength is second to none, withstanding even the most demanding installation conditions.

VaporBlock® protects your flooring and other moisture sensitive furnishings in your building's interior from moisture migration. VaporBlock can also greatly reduce condensation, mold and degradation by controlling water vapor migration.

Size & Packaging

VaporBlock® 6 &10 are available in 15' wide rolls by 200' long for ease of installation and maximum coverage.

VaporBlock® 15 is available in 12' wide rolls by 200' long. Other custom sizes are available depending upon size and volume requirements. All rolls are folded and rolled on heavy-duty cores for ease in handling and installation. Installation instructions and ASTM E-1745 classifications accompany each roll.

VaporBlock® UNDERSLAB VAPOR RETARDER

Vapor Barrier - Commercial

VaporBlock® Barrier

Product	Part #
VAPORBLOCK	VB6
VAPORBLOCK	VB10
VAPORBLOCK	VB15

APPLICATIONS

Underslab Vapor Retarder/Barrier

Foundation Wall Vapor Retarder

Radon Retarder

VAPORBLOCK® VB6, VB10 & VB15

High Performance Underslab Vapor Barrier

ISO 9001:2008 CERTIFIED MANAGEMENT SYSTEM

		VAPORBLOCK VB6		VAPORBLOCK VB10		VAPORBLOCK VB15	
PROPERTIES	**TEST METHOD**	Imperial	Metric	Imperial	Metric	Imperial	Metric
Appearance		Blue		Blue		Blue	
Thickness, Nominal		6 mil	0.15 mm	10 mil	0.25 mm	15 mil	0.38 mm
Weight		29 lbs/MSF	151 g/m²	49 lbs/MSF	249 g/m²	73 lbs/MSF	356 g/m²
Classification	ASTM E1745	CLASS C		CLASS A, B & C		CLASS A, B & C	
Tensile Strength Average MD & TD (New Material)	ASTM E154 Section 9, (D882)	32 lbs/in	56 N/cm	52 lbs/in	91 N/cm	88 lbs/in	154 N/cm
(After Exposure)		25 lbs/in	44 N/cm	53 lbs/in	93 N/cm	92 lbs/in	161 N/cm
Puncture Resistance	ASTM D1709 Method B	>1500 g		>2600 g		>4000 g	
Maximum Use Temperature		180° F	82° C	180° F	82° C	180° F	82° C
Minimum Use Temperature		-70° F	-57° C	-70° F	-57° C	-70° F	-57° C
Permeance (New Material)	ASTM E154 Section 7 ASTM E96 Procedure B	0.090 *Perms	0.060 **Perms	0.0146 *Perms	0.0096 **Perms	0.009 *Perms	0.0059 **Perms
(After Conditioning)	ASTM E154 Section 8, E96	0.105	0.069	0.0153	0.0101	0.0104	0.0069
	Section 11, E96	0.124	0.082	0.0151	0.0099	0.0102	0.0067
	Section 12, E96	0.097	0.064	0.0160	0.0105	0.0101	0.0067
	Section 13, E96	0.099	0.065	0.0181	0.0119	0.0091	0.0060
WVTR	ASTM E96 Procedure B	0.080 grain/hr-ft²	0.056 gm/hr-m²	0.0084 grain/hr-ft²	0.0059 gm/hr-m²	0.0054 grain/hr-ft²	0.0038 gm/hr-m²

* grains/(ft²·hr·in·Hg)
** g/(24hr·m²·mm Hg)

VaporBlock® Placement

All instructions on architectural or structural drawings should be reviewed and followed. Detailed installation instructions accompany each roll of VaporBlock® and can also be located on our website. ASTM E-1643 also provides general installation information for vapor retarders.

VaporBlock® high-performance vapor retarder/barriers are made from state-of-the-art polyolefin resins (virgin-grade) to provide unmatched impact strength and ultra-low water vapor permeance. VaporBlock® can be identified as blue in color printed with the VaporBlock® logo and the conformance information listing ASTM E 1745, classifications.

RAVEN INDUSTRIES
Engineered Films Division
P.O. Box 5107
Sioux Falls, SD 57117-5107
Ph: (605) 335-0174 • Fx: (605) 331-0333
Limited Warranty available at www.RavenEFD.com
Toll Free: **800-635-3456**
Email: **efdsales@ravenind.com**
www.VaporBlock.com
11/11 EFD 1092

APPENDIX B

STANDARD OPERATING PROCEDURES

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ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
SPILL PREVENTION AND RESPONSE DIVISION
STANDARD OPERATING PROCEDURE

Indoor and Outdoor Air Sampling Procedure During Vapor Intrusion Investigations

GENERAL PROVISIONS

The Alaska Department of Environmental Conservation's Spill Prevention and Response Division has created this standard operating procedure (SOP) as a default procedure to be followed for indoor air sampling.

PREPARATIONS FOR INDOOR AIR SAMPLING

Prior to the collection of indoor air samples, the following considerations should be made:

a) Do a pre-sampling inspection.

1. Perform pre-sampling inspection prior to each sampling event to identify conditions that may affect or interfere with the proposed testing.

2. The inspection should evaluate the type of structure, floor layout, physical conditions and airflows of the building(s) being studied.

3. Perform a building survey to identify potential sources of background interference.

4. If possible or available, record product name and manufacturer of background sources.

b) Eliminate potential interference.

Potential interference from products or activities releasing volatile chemicals may need to be controlled. Removing the source from the indoor environment prior to testing is the most effective means of reducing the interference. Ensure that the following activities are avoided 24 hours before sampling:

- Opening any windows, fireplace dampers, openings or vents.
- Operating ventilation fans unless special arrangements are made.
- Smoking in the building.
- Painting.
- Using wood stoves, fireplaces or other auxiliary heating equipment (e.g., kerosene heaters).
- Operating or storing vehicles in an attached garage.

- Allowing containers of gasoline or oil to remain in the building, except for fuel oil tanks.
- Cleaning, waxing or polishing furniture or floors with petroleum- or oil-based products.
- Using air fresheners or odor eliminators.

c) Select sampling locations.

Air samples should be collected from an adequate number of locations to understand likely sources of volatile chemicals and to assess potential exposure to occupants in various locations.

- In private residences, air samples should be collected from the basement, first-floor living space, and from outdoors.
- In schools and office buildings, samples should be collected during normally occupied periods to be representative of typical exposure.
- In special circumstances, it may be necessary to collect air samples at other times in order to minimize disruptions to normal building activities.
- Sample collection intakes should be located to approximate the breathing zone for building occupants (3 feet above the floor level where occupants are normally seated or sleep).
- Collect samples for at least a 24-hour period to ensure that an air sample is representative of the conditions being tested.
- Sampling personnel should avoid lingering in the immediate area of the sampling device while samples are being collected to avoid undue influence from sampling.

SAMPLING PROCEDURE

The samplers should be set up with a flow controller to provide at least a 24-hour time-weighted average (TWA) concentration.

1. Prior to the sampling event, contact the laboratory to confirm the required sampling size necessary to obtain the desired reporting limit.
2. Minimize sampling error by avoiding actions such as: fueling vehicles, using permanent marking pens, or wearing perfume that could cause sample interference.
3. Summa canisters should be used for sampling – not Tedlar bags.
4. Particulate filters, vacuum gauges and flow controllers should also be used when sampling.
5. Verify the initial vacuum of the canister. If the canister vacuum is less than 25 in. Hg, do not use.
6. Confirm the valve is closed.
7. Attach the particulate filter, flow controller and vacuum gauge, and place the brass cap at the end of the flow controller.

8. Open the valve briefly a half-turn, then close. Verify for one minute that the vacuum holds. If the needle on the gauge drops, then refit or tighten connections until the needle holds steady for one minute.
9. Remove the brass cap and open the valve a half-turn.
10. Record the vacuum on the chain of custody and canister tag.
11. Monitor sample progress periodically.
12. Close the valve by hand-tightening after the sampling interval is complete.
13. Fill out the chain of custody and relinquish samples properly.
14. Ship samples to the laboratory in a box under custody seal.

QUALITY ASSURANCE AND CONTROL

Each summa canister should be pre-cleaned and individually certified. Field sample Quality Assurance and Quality Control (QA/QC) should be verified by sampling handling procedures, including chain of custody, holding times, final vacuums and temperatures.

APPLICABILITY

This procedure applies to all employees of DEC/SPAR employees and to State of Alaska qualified persons.

– Oct. 4, 2013

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Protocol and Procedures Used by D, Hammond for Analysis of Rn in Indoor Air and Soil Vapor

(Updated 5/2/13)

Instrumentation:
Scintillation counters built by Applied Techniques (Model AC/DC-DRC-MK10-2) are used. This system uses Lucas type counting cells that have been built by Guy Mathieu, as noted on the Applied Techniques website. Cells are either 120 cc or 250 cc volume. For sample analysis, we evacuate a cell and use a plastic syringe to inject a sample of known volume directly into the cell, through a 5 cm long glass tube containing dririte (CaSO4). For high activity (subsurface) samples, we use 20-40 cc volumes and the smaller Lucas cells. For low activity samples (above ground), we use low background cells (0.04-0.13 cpm), and either 60 cc of sample in the smaller cell or 120 cc in the larger cells. Results are corrected for the difference in atmospheric pressure in the lab (near sea level) and at the sampling site (based on altitude), although this factor applies equally to surface and subsurface samples.

Standardization:
Counting efficiency for each cell/counter pair has been determined by extracting radon from standard solutions containing 226Ra. These solutions were prepared from aliquots of a standard obtained from NBS (now NIST) during the GEOSECS program. Five of these standards in regular use, and their relative activities have remained quite stable during the years they have been in use. These standards are run at least once per year to insure stability of the counting system. In 2009, samples were run in an inter-laboratory calibration exercise for 226Ra analysis and values consistent with other well-established groups were obtained. An additional intercalibration was run with Dr. Phil Jenkins of Bowser-Morner in April, 2013, and results were in good agreement (better than the counting uncertainty of about 5%). The effect of counting in the dry air matrix has been carefully evaluated, comparing results with values in the helium matrix in which cells are calibrated, to determine the small correction (1-5%) needed for the difference in counting matrix. Cells are internally intercalibrated, using high activity subsurface samples that are run in replicates with other cells. Cells with high backgrounds are intercalibrated two or more times per year, and cells with low backgrounds are intercalibrated about once per year. Experience has shown that the cell counting efficiencies change very little over many years, unless photomultiplier tubes (PMT) deteriorate. PMT performance is periodically checked (about twice per year) by measuring activity of an internal source of 241Am mounted in a Lucas cell.

Backgrounds and blanks:
Cell backgrounds are checked 2-3 times per year. These are not very critical for subsurface samples, but are very critical for low activity measurements. Consequently, the lowest background cells are used only for low activity samples. As a result, their backgrounds have remained very stable over the past 6 years. With careful attention to backgrounds, values measured for aged air (stored for more than one month) are within the counting uncertainty of zero. Consequently, we have determined that the blank is

zero. Any blank coming from the counting cell itself is accounted for by our cell background counts. Based on criteria defined by EPA (95% confidence level as recommended by EPA 402-R-95-012, Oct. 97), the LLD calculated for a typical analysis (120 cc sample, 0.10 cpm counting background, 12 hour count, and 3 days elapsed between collection and analysis) is 0.14 pCi/L. In practice, values for outside air are sometimes obtained that are lower than this LLD.

QA/QC:
We request collection of sufficient sample volume to permit at least one replicate analysis, if needed. Typically, about one of every 8-10 samples is analyzed in duplicate, to ensure quality control and randomly check performance of cells and counting equipment. The average precision of these lab duplicates (±1 sample standard deviation) is about ±3%, although our quoted precision is ±5%. If duplicates do not agree within this precision, they are re-run. Cell backgrounds and counting efficiency are measured regularly, as noted above.

Protocol:
Sample delivery within 2-3 days of collection is recommended. After arrival, the integrity of each sample container is checked by a simple pressure test of each bag to ensure that it does not leak. Storage tests have shown that the Tedlar bags are suitable for at least 10 days of storage without a detectable change in decay-corrected radon activity. One set of sampling syringes and dririte traps is used for low activity samples, and a second for high activity samples, to avoid cross contamination. Counting cells are allowed to "rest" for at least 4 hours before re-use to avoid influence of Rn daughters left in the cell from the previous sample. With this protocol, memory effects are insignificant. Samples are generally analyzed in the order listed on the COC, with hot samples run during day, as they usually need only 1-4 hours counting time, and low activity samples counted overnight. As noted above, low background cells are used for low activity samples. High background cells may have a background up to 1 cpm, and are only used for high activity samples.

Calculation of sample Activity:
After the sample is drawn into the counting cell, it is placed in the counter. Typically 3 readings are taken at intervals depending on sample activity. The consistency of these readings allows detection of spurious electronic noise or operator error (both are rare). Background counts are subtracted from the total counts observed in each interval, based on the average cell background. Radon has 2 short-lived alpha emitting daughters that grow into secular equilibrium during the count, and this ingrowth is considered by integrating the Bateman equations describing daughter ingrowth during each counting interval, to obtain the radon activity at the time the sample was introduced into the cell. We compare the results (with associated counting uncertainty) for each interval to ensure that this function is accurate, that the counting efficiencies for parent and daughter decays are identical, and that no spurious results were obtained. Results are averaged (weighted by duration of the counting interval) to obtain an average observed activity for the sample. If one interval differs from the other two by more than 3 standard deviations, it is rejected (this occurs less than 1% of the time). This result is then corrected for cell

counting efficiency, decay between sample collection and analysis, and the difference in atmospheric pressure between the lab and the sample site. No correction is made for temperature, as we assume that the field and lab temperatures are likely to be similar. A difference of 10°C would make only a 3% difference in concentration, less than the stated analytical uncertainty. Uncertainty based on counting statistics is computed, considering uncertainty from both sample and background counts. Additional uncertainty may come from cell standardization (<3%) or sample volume used (~1%), and the uncertainty reported (±1 standard deviation) for each sample is taken to be the larger of either that based on counting statistics, or 5%.

Additional details about analysis can be found at:

Analysis of standards using solutions with 226Ra
Mathieu, G., P. Biscaye, R. Lupton, and D. E. Hammond, 1988, System for measurement of radon-222 at low levels in natural waters, Health Physics, 55, 989-992.

Analysis of soil gas
McHugh, T. E., D. E. Hammond, T. Nickels, B. Hartman (2008) Use of Radon measurements for evaluation of volatile organic compound (VOC) vapor intrusion: Method and application, Environmental Forensics, 9, 107-114, doi: 10.1080/15275920801888491.

Sample Collection Instructions:

Equipment needed
-Polypropylene Syringes with appropriate stopcocks for closing (60 cc is convenient). If syringe is disconnected from a soil gas probe and then transferred to a bag, the syringe should have a two way stopcock for closure while it is disconnected.
-Tedlar bags for each sample, 0.5 liter size. The design with polypropylene fittings is best (often SKC Inc., Model 232-02 are used).

Sampling information needed on COC or bag:
-Sample ID and type (sub-surface, room, or ambient air to indicate how hot it may be)
-Sampling date and time (within 10 minutes or so), including the local time zone.
-The approximate site location (so we can to correct results to ambient air pressure)

General Comments
Samples are easily collected by syringe and transferred to the Tedlar bags. A small piece of tygon tubing (1/8" ID) is a convenient way to connect the syringe to the bag**. Use one syringe for 'cold' samples** (building or ambient air) **and a different one for 'hot' samples** (subsurface gas). **Handle bags with some care.** Some samples have had pinhole leaks created due to abrasion against rocks or other rough surfaces.

For subsurface samples, at least 100 cc should be collected. For room air or ambient air samples, at least 200 cc should be collected**. Bags should not contain more than about 300 cc of gas**. Overfilling can lead to failure if they are exposed to low pressure during shipment.

Sample Collection Instructions
Ambient and Room Air Samples: Label bag. Fill syringe with air, connect to bag, open valve (1/2 to ¾ turn), and push gas into bag. Repeat until about 240 cc is added. Close valve. **Gently squeeze bag to check for leaks (bag would deflate).**

Soil gas: Be sure sampling path from soil probe tip to syringe has been flushed adequately. Connect sample syringe to probe. Draw sample into syringe and transfer to bag, as above. Holding time in the polypropylene syringe should be less than 1 hour. **Gently squeeze bag to check for leaks (bag would deflate).**

Ship samples within 2 days to **Doug Hammond, Earth Sciences, 3651 Trousdale Pkwy, Los Angeles, CA 90089-0740 (tel. 213-740-5837 or 310-490-7896.** A stiff cardboard box makes a satisfactory shipping container. Send an email to dhammond@usc.edu to indicate that they are on the way.

For our ongoing research efforts it is appreciated (but not required) if samples of ambient (outdoor) air are identified.

APPENDIX C

SITE-SPECIFIC HEALTH AND SAFETY PLAN

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SITE SPECIFIC HEALTH AND SAFETY PLAN
FOR VAPOR INTRUSION MITIGATION INSTALLATION

4TH AND GAMBELL
ANCHORAGE, ALASKA

APRIL 28, 2014

Prepared For:

Environmental Quality Management, Inc.
18939 120th Avenue NE, Suite 103
Bothell, Washington 98011

Prepared By:

Ahtna Engineering Services, LLC
110 W 38th Ave., Suite 200A
Anchorage, AK 99503

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SITE SPECIFIC EMERGENCY INFORMATION

Title	Name	Phone Number
EMERGENCY		
Ambulance		911
Fire		911
Police		911
Closest Hospital	Alaska Regional Hospital	(907) 276-1131
PERSONNEL		
AES Contract Manager	Nino Muniz	Office: (907) 433-0731 / Cell: (b) (6)
AES Project Manager	Olga Stewart	Office: (907) 865-3865 / Cell: (b) (6)
AES Field Team Lead	Nate Oberlee (Rescon)	Office: (907) 677-7423 / Cell: (b) (6)
AES SSHO	Olga Stewart	Office: (907) 865-3865 / Cell: (b) (6)
AES CIH, CSP	Pete Rice	Office: (916) 372-2000 / Cell: (b) (6)
Client Project Manager	Bryan Chernick	Office: (425) 673-2900
Oversight Project Manager	Carl Overpeck	Office: (907) 257-5000
SUBCONTRACTORS		
PetroChem - AK	Mike Glover	Office: (303) 349-8974
Land Science Tech - CA	Kelly Amelie	Office: (949) 892-0542
AAA Moving - AK	Lori	Office: (907) 276-3506 / Cell: (b) (6)

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A: Acknowledgement Form
B: MSDS/PADS
C: Daily Tailgate Meeting Form
D: Blank Accident/Injury/Illness/Incident Report

ACRONYMS AND ABBREVIATIONS

ADEC.....Alaska Department of Environmental Conservation
AES .....Ahtna Engineering Services Limited Liability Company
AST .....aboveground storage tank
CC .....Crisis Coordinator
C.I.H.....Certified Industrial Hygienist
CPR.....cardiopulmonary resuscitation
C.S.P. .....Certified Safety Professional
EPA.....United States Environmental Protection Agency
°F.....degrees Fahrenheit
HSP .....Site-Specific Health and Safety Plan
IIPP .....Injury Illness and Prevention Program
mg/m3 .....milligram per cubic meter
MSDS.....Material Safety Data Sheets
NIOSH .....National Institute for Occupational Safety and Health
OSHA.....Occupational Safety and Health Administration
PADS .....Physical Agent Data Sheets
PEL .....Permissible Exposure Limit
PID .....photoionization detector
PM.....Project Manager
PPE.....personal protective equipment
ppm .....parts per million
REL .....Recommended Exposure Limit
SSHO .....Site Safety and Health Officer
VOC .....volatile organic compound
U.S. .....United States
UST .....underground storage tank
WP.....work plan

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1.0 INTRODUCTION

The Ahtna Environmental, Inc. (AES) Injury Illness and Prevention Program (IIPP) dated June 2010 will be utilized for general AES corporate health and safety issues. In addition, this Site-Specific Health and Safety Plan (HSP) has been prepared by AES as a supplement to the IIPP to address site-specific health and safety concerns associated with the Vapor Intrusion Mitigation System Installation in Anchorage. The work plan describes the installation and monitoring activities to be performed by AES.

Control of the site potential hazards involves the entire crew understanding and implementing the provisions of this HSP. Employees are ultimately responsible for their own safety and the safety of those working around them. Employees will be required to follow safe work practices, use appropriate monitoring equipment and personal protective equipment (PPE) correctly, and follow emergency procedures when required. The AES Project Manager (PM) has the overall responsibility for ensuring that the means are available to supply site personnel with the appropriate equipment, tools, material, and PPE when required. The Site Safety and Health Officer (SSHO) shall be responsible for ensuring the implementation and enforcement of this HSP during project activities.

This HSP provides guidelines and procedures for protecting the health and safety of individuals performing work at the project site. In addition, this HSP presents an analysis of potential physical and chemical hazards that may exist at the work site or may arise in relation to the conduct of planned activities. Based on the hazard analysis, recommended controls are provided to eliminate or reduce the hazards that may be present. The provisions of this HSP are mandatory for all activities conducted at the site under the direction of AES.

It is a requirement of this HSP that an approved copy be kept at the project site. In addition, all AES personnel assigned to the project site are required to read, understand, and comply with the provisions and requirements for this HSP, including attachments and documents incorporated by reference. AES personnel will document such understanding and compliance by signing the Health and Safety Plan Acknowledgement Form included in Appendix A.

1.1 Site Location

The Alaska Real Estate Parking Lot site is located at the northeast corner of 4th Avenue and Gambell Street in Anchorage, Alaska, approximately 1.3 miles east of Cook Inlet's Knik Arm. The approximate location is latitude 61° 13'17.81" north and longitude -149° 52'11.95" west within Section 18, Township 13 North, and Range 3 West of the Seward Meridian.

1.2 Site History

Three structures were previously located on the property: a dry cleaner in one building on the west side of the property from 1968-1970 and a tire center/automotive shop located in two buildings on the eastern side of the property from 1976-1978 (E&E, 2013). Contamination found at the site includes VOCs typically associated with dry cleaning, including PCE, and one of its breakdown products trichloroethylene (TCE). Three other breakdown products cis-1,2-

dichloroethylene (cDCE), trans-1,2-dichloroethylene (tDCE), and vinyl chloride (VC) have not been detected at the site but have been detected downgradient.

The property is generally flat at approximately 110 feet above mean sea level. The surrounding area has a gentle slope to the north towards the Ship Creek drainage at which point a steep drop-off in elevation occurs. To the north of the site are residential buildings including single- and multi-family dwellings. Further north is the former location of the Alaska Native Hospital.

1.3 Contaminants of Concern

Contaminants of concern (COCs) are based on historic groundwater sampling in the area are VOCs, specifically PCE and TCE. Daughter products cDCE, tDCE, and VC and other VOCs have been found in select areas downgradient.

1.4 Site Activities

Ahtna will execute the following tasks to meet the project objectives:

- Coordinate with AAA moving to removing building occupant belongings from basements of homes and store onsite in conex containers.
- AES will collect radon air samples from all four buildings prior to site work.
- PetroChem (subcontractor) will install Retro-Coat™ coating in three of the residences.
- AES to install mitigation system components in four residences.
- AES will collect indoor air samples from all four buildings following system installation.

2.0 JOB HAZARD ANALYSIS

Potential hazards associated with this project include physical and chemical hazards. The following sections discuss the physical, chemical, and biological hazards anticipated during site operations and the measures to be implemented by AES to eliminate or minimize these hazards.

2.1 Physical Hazards

Physical hazards are inherently present during most field operations and include the following.

- Use of heavy equipment;
- Vehicular traffic;
- Slips, trips, or falls;
- Lifting heavy objects;
- Cuts and/or bruises;
- Mechanical hazards associated with the use of tools and other equipment;
- Excessive noise;
- Inclement weather; and
- Stress due to heat or cold.

A copy of applicable Alaska State Physical Agent Data Sheets (PADS) and Material Safety Data Sheets (MSDS) will be available onsite during site activities and are attached in Appendix B.

2.1.1 Slips, Trips, or Falls

Many of the activities at this site can expose workers to slip, trip, or fall hazards. Work areas will be maintained in as neat and orderly a state as practical to prevent slips, trips, or falls. Equipment will not be stored in foot-traffic routes. Tools and materials will not be left lying around when not in direct use. All AES site staff will ensure work areas are clean and orderly. Care will be taken when walking through or working in uneven terrain (e.g., berms, vegetation, ditches, etc.) or on wet surfaces. Good footwear and constant awareness will help reduce slips, trips, and falls. Prior to initiating site activities, work areas shall be inspected to identify pre-existing slip, trip, and fall hazards. Pre-existing slip, trip and fall hazards shall be marked, barricaded, or removed prior to the initiation of site activities.

2.1.2 Lifting Heavy Objects

Many activities may require lifting heavy objects or heavy physical labor. For manual material handling tasks, personnel will be trained in proper lifting techniques. When heavy objects must be lifted manually, workers will keep the load close to the body, use their legs to lift and avoid any twisting or turning motions to minimize stress on the lower back. An adequate number of personnel or an appropriate mechanical device will be used to lift or handle heavy objects whenever feasible.

2.1.3 Using Tools and Equipment

Hazards present during the use of tools and equipment are generally associated with improper tool handling, not wearing PPE, or inadequate maintenance. Management of these hazards will involve rigorous maintenance of tools and equipment and employee training in the proper use of various tools prior to use to ensure safe working condition. Defective tools and equipment shall be immediately removed from service for repair or replacement.

2.1.4 Utilities

Project activities require intrusive subsurface activities and extreme care and proper planning will be used in order to avoid contact with underground and/or overhead power lines, water and sanitary sewer lines, storm drains, and other utilities if present at the project site. Safe distances of at least 10 feet will be maintained from overhead power lines to booms, masts, and other such equipment extensions, if applicable. If underground utilities are present or suspected to be present, hand excavation, probing, or other suitable means shall be used to locate the utilities when intrusive activities are within three feet of the expected utility location.

2.1.5 Excessive Noise

Work on this project may subject workers to noise in excess of allowable limits, particularly when working near vehicles, heavy equipment, drilling equipment, or gasoline- and electric-powered tools and equipment. Personnel who do not need to be near loud equipment should stay away to lower the risk of noise-induced hearing loss. Personnel who must work near such equipment will be required to wear hearing protection (earplugs or muffs) to reduce their exposure to excessive noise. The use of ear plugs or ear-muffs is mandatory when noise prevents conversation in a normal voice at a distance of three feet. This “rule of thumb” is an indication that noise levels may exceed the OSHA action level of 85 decibels (time-weighted average). Personnel required to wear hearing protection will be in a Hearing Conservation Program in compliance with 29 CFR 1910.95. Methods used to comply with OSHA hearing conservation requirements are set forth in the AES IIPP.

2.1.6 Inclement Weather

Weather is an important consideration in site operations. Extremely hot or cold weather, high winds or heavy rains can cause physical discomfort, loss of efficiency, and increase the potential for stress and personal injury. At the direction of the SSHO, work will be stopped in the event of high winds (over 30 miles per hour), heavy rain, lightning, or hail.

2.1.7 Heat or Cold Stress

During the proposed field activities, heat or cold stress may become a significant risk factor and personnel should be trained on how to recognize and prevent heat/cold stress illnesses. Cold stress monitoring will consist of observing workers at rest or at work for symptoms of exposure, including numbing of extremities, shivering, apathy, or listlessness. The wind chill factor will also be taken into consideration. Workers will avoid removing sweat-soaked clothing until in a

warm area. The SSHO will ensure that all workers potentially exposed to low temperatures are properly clothed.

The SSHO will initiate a heat stress monitoring program whenever personnel are wearing semi-permeable or impermeable protective clothing and the outside temperature reaches 70 degrees Fahrenheit (°F). Heat stress monitoring is not anticipated for this project.

2.1.8 Material Handling

Pinch points and crush by/struck by hazards are present when personnel are required to work in close proximity to material handling equipment. The following procedures shall be implemented when handling field equipment and materials.

- Personnel shall keep their fingers out of pinch points such as between rigging material and forks on equipment of the sides of the containers.
- Personnel shall not position themselves between material handling equipment and the containers or be permitted to walk or stand under a suspended load
- Spotters shall be provided when ground personnel are working near material handling equipment.

Ground personnel shall wear reflective, high-visibility vests when working near material handling equipment.

2.2 Chemical Hazards

During monitoring well installation, development, and sampling, personnel exposure to chlorinated solvents is possible. Routes of exposure include inhalation of vapors, direct dermal contact with contaminated materials, and ingestion of contaminated materials

Symptoms of exposure and OSHA thresholds are found in Table 2-1. Based on the OSHA action level for VC, the field screening threshold will be set at 0.5 ppm. If the field screening threshold is continually exceeded in the breathing zone of workers, exposure will be reduced by moving away and/or upwind from the source. If this cannot be achieved, the level of PPE will be upgraded to protect site workers from chemical exposure.

TABLE 2-1: OSHA THRESHOLDS AND SYMPTOMS OF EXPOSURE

Contaminant	OSHA Exposure Limits	IDLH	Exposure Symptoms
PCE	Carcinogen TWA: 100 ppm C: 200 ppm	150 ppm	Irritation to eyes/skin/nose/throat, nausea/flushed face/neck, dizziness/drowsiness
TCE	Carcinogen TWA: 100 ppm C: 200 ppm	1000 ppm	Irritation to eyes/skin/nose/throat, nausea/dizziness/drowsiness, irregular heartbeat
cDCE, tDCE	TWA: 200 ppm	1000 ppm	Irritation to eyes/throat, depressed central nervous system

Contaminant	OSHA Exposure Limits	IDLH	Exposure Symptoms
VC	Carcinogen TWA: 1ppm C: 5ppm	ND	Irritation to eyes/throat, dizziness/drowsiness, headaches, loss of consciousness

Key:
C Ceiling concentration not to be exceeded for any part of the workshift
IDLH Immediately Dangerous to Life or Health
ND Not Determined
TWA Time Weighted Average not to be exceeded during any 8-hr workshift of 40-hr workweek

The SSHO shall be responsible for ensuring that proper PPE and personal hygiene practices are available and implemented during the performance of project activities to reduce the possibility of exposure to contaminated media through inhalation or dermal contact. Care will be taken to avoid causing dust to become airborne. If dust becomes a factor, half-face respirators with HEPA filters will be worn. Leather outer gloves will be worn during most activities.

2.3 Biological Hazards

There is the possibility for exposure to insects (i.e. mosquitoes). Employees will wear long pants, socks, long-sleeved shirts, and if necessary, head-nets when outdoors to reduce the chances of being bitten by mosquitoes.

3.0 TRAINING REQUIREMENTS

AES personnel assigned to this project site will obtain health and safety clearances before and beginning work, and:

- Participate in the AES medical surveillance program, in accordance with 29 CFR 1910.120.
- Have successfully completed a 40-hour Hazwoper course in accordance with 29 CFR 1910.120.
- Have successfully completed an 8-hour Hazwoper refresher course within the past 12 months in accordance with 29 CFR 1910.134.
- Have received proper respirator fit testing in accordance with the AES written respiratory protection program and 29 CFR 1910.134.

In addition to the training requirements listed above, the SSHO must hold a valid certificate in first aid and CPR Training from the American Red Cross, or an equivalent agency.

Visitors to the project site, including regulatory agency personnel, must first receive a site-specific briefing by the SSHO.

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4.0 SAFE WORK PRACTICES

The following safe work practices will be implemented to support health and safety at the project site:

- AES site personnel and authorized visitors will be required to read this HSP and comply with its contents completely. Personnel will sign the Health and Safety Plan Acknowledgment Form presented in Appendix A.
- PPE will be worn as required by this HSP (anticipated to be level D PPE).
- Equipment will be maintained in proper working order, free of accumulated lubricants, contaminants, or other hazardous of flammable substances.
- Fuels or other flammable substances will be kept at least 50 feet away from the ignition sources. Fuel containers and other containers of hazardous substances will be properly labeled.
- Good housekeeping will be practiced at all times.
- Tools will be kept clean and maintained in good working condition.
- Personnel will report to the project site ready for work and free from the influence of alcohol, illegal or controlled substances, and prescription or non-prescription pharmaceuticals that may affect their ability to work safely.
- Personnel are required to report all injuries, near misses, and incidents to the SSHO, even if the incident is considered minor.
- Personnel will follow the direction of the SSHO on the safety or health matters, stop-work orders, or emergency evacuations.
- Personnel are expected to obey medical or work restrictions and to inform the SSHO (or, in case of subcontractors, their employer's supervisor) of any potentially relevant medical conditions that may affect their safety or the safety of others.
- Personnel are expected to maintain a high level of safety awareness.
- Personnel are expected to identify and report unsafe conditions, damaged or inadequate PPE, and other conditions that they believe are potentially hazardous.
- Face and hands must be thoroughly washed upon leaving a contaminated or suspected contaminated area.
- Excessive facial hair that interferes with a satisfactory fit of the respirator-to-face seal will not be permitted when site conditions dictate necessity of respirator use.
- Contact with potentially contaminated substances will be avoided. Personnel will not walk through puddles, pools, or mud; kneel on the ground; lean or sit on equipment; or place monitoring equipment or tools on potentially contaminated surfaces.
- Equipment decontamination will be performed in an appropriate level of PPE.
- If personnel do not fulfill health and safety responsibilities, they will be denied site access.

The SSHO will monitor weather conditions. Operations will be suspended during periods of inclement weather.

4.1 Contaminant Monitoring

Contaminant monitoring will be conducted as specified in Section 2.2.

4.2 Personal Protective Equipment

PPE will be worn during project activities. The initial level of PPE required is Level D, absent modification due to air monitoring results or other site conditions. The typical equipment necessary for Level D PPE is as follows:

- Hard hat
- Safety glasses
- Steel-toed work shoes or boots
- Leather gloves for equipment operators
- Nitrile gloves for environmental technicians
- Hearing protection (muffs or plugs), as needed
- Long pants and long-sleeved shirts or cloth coveralls
- High visibility vests

If required, Level D PPE may be upgraded to Modified Level D or to Level C. Modified Level D PPE includes the above items plus Tyvek® coveralls and nitrile or rubber outer gloves. Level C PPE is the same as Modified Level D, but includes a half-face air purifying respirator fitted with organic vapor cartridges.

4.3 Personnel Decontamination

Decontamination for personnel wearing Level D PPE will consist of the requirement for site personnel to wash their hands, arms, face, and neck prior to eating, drinking, and smoking. Disposable boot covers, if worn, should be removed and placed in a trash bag for disposal. Decontamination for Modified Level D and Level C will be as follows:

- Wash boots or boot covers and outer gloves, if worn, with a long-handled brush in a wash basin containing detergent (Alconox or equivalent) and water.
- Rinse boots and outer gloves, if worn, with water using a long-handled brush in a wash basin containing water.
- Remove tape used to seal the gloves and boot covers, if worn, and place in appropriate container.
- Remove outer gloves and place in appropriate container.
- Remove respirator, if worn, and place on equipment table for decontamination.
- Place inner gloves in appropriate container.
- Wash hands, arms neck and face prior to eating, drinking, or smoking.
- Personnel are advised to shower as soon as possible after leaving the site.

Respirators, if worn, shall be decontaminated in a 4-stage process that includes an initial wash with soap and water, a rinse in clean water, a 5-minute soak in a bleach and water solution (or other appropriate disinfectant recommended by the respirator manufacturer), and a final rinse in clean water. Respirators should be permitted to air dry in a clean atmosphere and should be properly stored when not in use.

4.4 Equipment Decontamination

Equipment shall be decontaminated prior to demobilization as described in the work plan.

4.5 Safety Meetings

Project personnel must attend a comprehensive pre-job health and safety orientation to be conducted by the SSHO prior to the start of project activities. The SSHO will review the contents of this HSP and communicate the nature and extent of potential physical and chemical hazards at the site. At a minimum, project health and safety orientations shall include the following topics:

- Names of personnel and alternates responsible for site safety and health
- Physical and chemical hazards anticipated during project activities
- Symptoms of overexposure to chemicals of concern
- Emergency response procedures and location of emergency equipment
- Prevention, symptoms, and treatment for heat/cold stress
- PPE (initial PPE levels, action levels)
- Instructions for use of satellite phone
- Emergency numbers and route to airstrip for Medevac pickup
- Decontamination procedures

Each morning prior to the start of operations, site personnel will receive job specific, safety briefings. Daily safety meetings will be used to complete required onsite training requirements and to review site hazards and the controls that will be implemented to control those hazards. Attendance at the daily safety meetings shall be mandatory for all site personnel, and attendance shall be documented. A Daily Tailgate Safety Meeting form is provided in Appendix C.

4.6 Record Keeping

Copies of all pertinent safety materials, including certificates, programs, plans, safety meeting attendance sheets, and other related safety documents, will be kept on the site and maintained by the SSHO. During demobilization, the project files will be transported to the AES Anchorage, Alaska office for document retention.

4.7 Communication

AES accounts for communications in our project locations by cellular phones and e-mail. In addition, AES recognizes the importance of experienced field staff to reduce the need to depend on communications with outside project management to maintain project efficiency and outcome.

4.8 Subcontractors

Subcontractors will be responsible for the health and safety of their personnel. AES will provide a copy of this HSP and other related information to its subcontractors. Subcontractor employees will be required to attend the daily safety meetings. Failure to conform to basic safety procedures

and correct problems immediately will result in disciplinary actions that may include termination.

5.0 EMERGENCY PROCEDURES

5.1 Emergency Equipment

Emergency equipment will be stored at appropriate onsite locations selected during site mobilization. Emergency response equipment may be moved from one location to another based on changing locations of activities. The following is a list of emergency equipment that will be on site:

- Fire extinguisher (20 pound A/B/C type)
- First aid kit (At least one industrial first-aid kit will be provided and maintained fully stocked at the site.)
- Drinking water
- Absorbent pads
- Shovels and other miscellaneous hand tools

5.2 Local Emergency Information

Emergency telephone numbers are presented on the inside cover of this HSP.

Personnel with minor injuries that require more than field first aid will be transported to the Alaska Regional Hospital in Anchorage, Alaska (see Figure 1).

5.3 Emergency Response Procedures

The SSHO has the responsibility and authority for coordinating emergency response activities until proper authorities arrive and assume control. In addition, the SSHO has the responsibility of alerting emergency services personnel (see emergency telephone numbers listed above) of the need and/or arrival of emergency medical transport and ensuring that such transport has full access to injured personnel.

When calling for assistance in an emergency situation, the following information should be provided:

- Name of caller
- Caller's location
- Name(s) of person(s) exposed or injured
- Nature of emergency
- Actions taken

The recipient of the call should hang-up first- **not** the caller.

5.4 Releases or Spills

In the case of a release of fuels, lubricants, or other hazardous substances, the SSHO will be immediately contacted. She will then immediately contact the ADEC Project Manager.

5.5 Fire or Explosion

In the event of a fire, the Anchorage Fire Department will be notified immediately. If the area is not safe, evacuate the area immediately. If it is safe to do so, trained site personnel may:

- Use fire-fighting equipment available on site to control or extinguish the fire.
- Remove or isolate flammable or other hazardous materials that may contribute to the fire.

In the event of an explosion, all personnel will be evacuated, and the local fire department will be notified immediately. No one will re-enter the area until it has been cleared by the fire department or other safety personnel.

5.6 Reporting of Accidents and Injuries

The AES PM and the ADEC PM will be immediately notified in writing in the event of a serious incident, including those requiring a physician's treatment. Near misses and accidents, without regard to their severity, will be reported in writing to the AES PM within 24 hours. The SSHO will complete this documentation. A worker's compensation form will also be submitted to the State in which an injured employee resides. The appropriate agency(ies) will also be notified, if required. Following any serious incident, an investigation will be completed by the SSHO and, if necessary, the PM. The AES PM will be responsible for following up on recommendations from the investigation. Necessary corrective actions will be taken to prevent recurrence of similar incidents. Accident/Injury/Illness/Incident Report forms are presented in Appendix D.

The following types of incidents are considered reportable:

- Physical injury (a log of first aid administered on site will be kept)
- Fire, explosions, or flashes
- Serious infractions of safety rules and requirements
- Unexpected chemical exposures
- Near misses
- Vehicular accidents
- Property damage
- Injuries to the public
- Damage to private property
- Bites or stings

The following types of incidents are to be reported immediately to the AES PM:

- Those likely to result in death or permanent disability
- Those requiring hospitalization
- Those involving two or more employees
- Those that are likely to receive coverage by new media, so that families may be notified by the company beforehand, if possible
- Those involving collapse, cave-in, or other failure of structures or equipment

- Serious accidents involving equipment or vehicles

Work will be suspended to correct the cause of the incident and to modify this HSP if necessary.

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6.0 REFERENCES

Ahtna Engineering Services, Limited Liability Company (AES), *Injury and Illness Prevention Program Manual (IIPP)*, June 2010.

American Conference of Governmental Industrial Hygienists (ACGIH), *Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices*, 2010.

Ecology and Environment (E&E), 2013. *Fourth Avenue and Gambell Parking Lot Site Inspection, Anchorage, Alaska*, Contract Number EP-S7-06-02, Technical Direction Document Number 12-01-0004. February.

National Institute for Occupational Safety and Health (NIOSH)/ Occupational Safety and Health Administration (OSHA)/United States (U.S.) Coast Guard (USCG)/U.S. Environmental Protection Agency (EPA), *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, October 1985.

NIOSH, *Pocket Guide to Chemical Hazards*, September 2005.

U.S. Department of Labor OSHA, *29 Code of Federal Regulations (CFR) Title 29, Part 1910 – Occupational Safety and Health Standards*.

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FIGURE

Figure 1

Hospital Location Map

APPENDIX A

ACKNOWLEDGEMENT FORM

Site Health and Safety Plan Acknowledgement Form

Project Name: _____ **Project No.:**_____

This is to certify that I have read this Site Health and Safety Plan (HSP) and understand its contents. I have attended a site orientation and safety briefing discussing the elements of this HSP and the safety and health hazards associated with operations to be performed at this site. Failure to comply with the requirements contained in this HSP may result in my removal from the project.

PRINT NAME	SIGNATURE	DATE

APPENDIX B

MSDS / PADS

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MATERIAL SAFETY DATA SHEETS
127-18-4/E-2

DATE: 29Apr2011

SUPPLIER ADDRESS: Air Liquide
6141 EASTON RD
PO BOX 310
PLUMSTEADVILLE, PA 18949-0310

EMERGENCY PHONE NUMBER: (215) 766-8860

---

1. CHEMICAL PRODUCT

PRODUCT NAME: TETRACHLOROETHYLENE

SYNONYMS: Perchloroethylene, Ethylene tetrachloride

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2. COMPOSITION, INFORMATION ON INGREDIENTS

Ingredient Name	Formula	CAS#	Concentration	Exposure Limits (PPM) ACGIH TLV	OSHA PEL	Other MAC	Other STEL
TETRACHLOROETHYLENE	C2CL4	127-18-4	99+%	25	100	35	100

---

3. HAZARD IDENTIFICATION

*** EMERGENCY OVERVIEW ***

Nonflammable liquid and vapor.
May cause irritation to the respiratory tract and skin.

POTENTIAL HEALTH EFFECTS

ROUTES OF ENTRY: Inhalation , Ingestion

ACUTE EFFECTS: Inhalation causes irritation of the respiratory tract. Symptoms include numbness, dizziness, incoordination, metallic taste, nausea, vomiting, vertigo, sinus inflammation, headache, anorexia, giddiness, inebriation, premature ventricular beats and unconsciousness. Skin and eye irritation may occur.

CHRONIC EFFECTS: Impaired memory, paralysis, nerve damage, liver and kidney damage, reproductive disorders, dermatitis and conjunctivitis. Suspected human

carcinogen.
MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None known
OTHER EFFECTS OF OVEREXPOSURE: None
CARCINOGENICITY (US Only):
NTP - Yes
IARC MONOGRAPHS - Yes
OSHA REGULATED - No

4. FIRST AID MEASURES

INHALATION: Immediately remove victim to fresh air. If breathing has stopped,
give artificial respiration. If breathing is difficult, give oxygen.
EYE CONTACT: Immediately flush with copious amounts of water for at least 15 minutes.
SKIN CONTACT: Immediately flush with copious amounts of water for at least 15 minutes while removing contaminated clothing.
INGESTION: Never give anything by mouth to an unconscious person. Have conscious and alert person drink 1 to 2 glasses of water. Do not induce vomiting because of aspiration hazard.
IN EVENT OF EXPOSURE, CONSULT A PHYSICIA
NOTE TO PHYSICIAN: None

5. FIRE FIGHTING MEASURES

FLASH POINT: Nonflammable
AUTOIGNITION TEMPERATURE: N/Ap
FLAMMABLE LIMITS: Nonflammable
LOWER:
UPPER:
EXTINGUISHING MEDIA: Use what is appropriate for surrounding fire.
SPECIAL FIRE FIGHTING INSTRUCTION AND EQUIPMENT: Wear self-contained breathing apparatus and full protective clothing. Keep fire exposed cylinders cool with water spray. If possible, stop the product flow.
HAZARDOUS COMBUSTION PRODUCTS: Toxic carbon monoxide and hydrogen chloride may be given off.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Cylinder rupture may occur under fire conditions.

---

6. ACCIDENTAL RELEASE MEASURES

CLEAN UP PROCEDURES: Evacuate and ventilate area. Shut off source if possible and remove source of heat. Absorb spills using a solid absorbant such as vermiculite.

SPECIALIZED EQUIPMENT: None

---

7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING: Secure cylinder when using to protect from falling. Use suitable hand truck to move cylinders. Intense UV light can decompose tetrachloroethylene to toxic and corrosive materials.

PRECAUTIONS TO BE TAKEN IN STORAGE:
Store in well ventilated areas. Store away from heat, flame, and sparks. Smoking, welding, open flame etc. should not be permitted in area of use or storage. Keep valve protection cap on cylinders when not in use.

---

8. EXPOSURE CONTROLS/ PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide adequate general and local exhaust ventilation to maintain concentration below exposure limits.

PERSONAL PROTECTION

EYE/FACE PROTECTION: Safety glasses
SKIN PROTECTION: Protective gloves.
RESPIRATORY PROTECTION: In case of leakage, use self-contained breathing apparatus.
OTHER PROTECTIVE EQUIPMENT: Safety shoes when handling cylinders.

---

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Colorless
ODOR: Sweet ether-like odor.
PHYSICAL STATE: Liquid
VAPOR PRESSURE: @22 deg.C: 15.8 mm Hg

VAPOR DENSITY (AIR=1): 5.8
BOILING POINT (C): 121
SOLUBILITY IN WATER: 0.04%
SPECIFIC GRAVITY (H2O=1): @20 deg.C:
1.623
EVAPORATION RATE: (CCl4=1): 0.27
ODOR THRESHOLD: 47 to 71ppm

10. STABILITY AND REACTIVITY

STABILITY: Stable under normal storage conditions.
CONDITIONS TO AVOID: Storage in poorly ventilated areas. Storage near a heat source.
MATERIALS TO AVOID: Lithium, barium, aluminum (powder), finely dispersed metals, dinitrogen tetroxide, sodium hydroxide, beryllium powder, hydrogen and nitric oxide.
HAZARDOUS POLYMERIZATION: Will not occur.
HAZARDOUS DECOMPOSITION: Hydrogen chloride and phosgene can be produced upon exposure to high temperature or from exposure to electric arcs. Toxic carbon monoxide.

11. TOXICOLOGICAL INFORMATION

LETHAL CONCENTRATION (LC50): 14,255 ppm, rat one hour.
LETHAL DOSE 50 (LD50): N/Ap
TERATOGENICITY: N/Ap
REPRODUCTIVE EFFECTS: N/Ap
MUTAGENICITY: N/Ap

12. ECOLOGICAL INFORMATION

No adverse ecological effects are expected.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Dispose of non-refillable cylinders in accordance with federal, state and local regulations. Allow gas to vent slowly to atmosphere in

an unconfined area or exhaust hood. If the cylinders are the refillable type,
return cylinders to supplier with any valve outlet plugs or caps secured and
valve protection caps in place.

14. TRANSPORT INFORMATION

CONCENTRATION: 99+%
DOT DESCRIPTION (US ONLY):
PROPER SHIPPING NAME:
Tetrachloroethylene
HAZARD CLASS: 6.1 (poison), Packing group III
IDENTIFICATION NUMBER: UN1897
REPORTABLE QUANTITIES: 100lbs
LABELING: KEEP AWAY FROM FOOOD
ADR/RID (EU Only): Class 6.1, 15(c)
SPECIAL PRECAUTIONS: Cylinders should be transported in a secure upright position in a well ventilated truck.

15. REGULATORY INFORMATION

OSHA: Process Safety Management: Material is not listed in appendix A of 29 CFR
1910.119 as highly hazardous chemical.
TSCA: Material is listed in TSCA inventory.
SARA: The threshold planning quantity for material is 10,000 lbs.
EU NUMBER: 204-825-9
NUMBER IN ANNEX 1 OF DIR 67/548: Not listed in annex 1.
EU CLASSIFICATION: N/Av
R: 40
S: 23, 36/37

16. OTHER INFORMATION

OTHER PRECAUTIONS: Protect containers from physical damage. Do not deface
cylinders or labels. Cylinders should be refilled by qualified producers of
compressed gas. Shipment of a compressed gas cylinder which has not been filled
by the owner or with his written consent is a violation of federal law (49 CFR).

ABBREVIATIONS:
N/Ap - Not Applicable
N/Av - Not Available
SA - Simple Asphyxiant
NE - None Established

MATERIAL SAFETY DATA SHEETS
79-01-6/E-3

DATE: 29Apr2011

SUPPLIER ADDRESS: Air Liquide
6141 EASTON RD
PO BOX 310
PLUMSTEADVILLE, PA 18949-0310

EMERGENCY PHONE NUMBER: (215) 766-8860

---

1. CHEMICAL PRODUCT

PRODUCT NAME: TRICHLOROETHYLENE

SYNONYMS: Ethylene trichloride, Trichloroethene

---

2. COMPOSITION, INFORMATION ON INGREDIENTS

Ingredient Name	Formula	CAS#	Concentration	Exposure Limits (PPM) TLV	OSHA PEL	Other MAC	Other STEL
TRICHLOROETHYLENE	C2HCl3	79-01-6	99+%	10	100	NE	25

Note: NE = NONE ESTABLISHED

---

3. HAZARD IDENTIFICATION

*** EMERGENCY OVERVIEW ***

Poisonous, flammable liquid and vapor.
May be fatal if inhaled.
May cause heart, liver and kidney damage.
May cause irritation to the respiratory tract and skin.

POTENTIAL HEALTH EFFECTS

ROUTES OF ENTRY: Inhalation , Ingestion , Skin

ACUTE EFFECTS: Inhalation causes irritation of the respiratory tract. Symptoms include shortness of breath, headache, confusion, nausea, dizziness, and unconsciousness. Severe exposure may cause unconsciousness and death. Eye contact may cause irritation, redness, or blurred vision. Skin contact can cause defatting and dermatitis. Can be absorbed through the skin. Ingestion irritates

the digestive tract and may cause partial paralysis, unconsciousness and kidney
damage.
CHRONIC EFFECTS: Kidney and liver damage. Heart damage. Alteration of genetic
material. Suspected human carcinogen.
MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None known
OTHER EFFECTS OF OVEREXPOSURE: None
CARCINOGENICITY (US Only):
NTP - Yes
IARC MONOGRAPHS - Yes
OSHA REGULATED - No

4. FIRST AID MEASURES

INHALATION: Immediately remove victim to fresh air. If breathing has stopped,
give artificial respiration. If breathing is difficult, give oxygen.
EYE CONTACT: Immediately flush with copious amounts of water for at least 15 minutes.
SKIN CONTACT: Immediately flush with copious amounts of water for at least 15 minutes while removing contaminated clothing.
INGESTION: Never give anything by mouth to an unconscious person. Have conscious and alert person drink 1 to 2 glasses of water. Induce vomiting after victim drinks water.
IN EVENT OF EXPOSURE, CONSULT A PHYSICIA
NOTE TO PHYSICIAN: None

5. FIRE FIGHTING MEASURES

FLASH POINT: N/Av
AUTOIGNITION TEMPERATURE: 420 deg.C
FLAMMABLE LIMITS: Vol.% @ 25 deg.C
LOWER: 8
UPPER: 10.5
EXTINGUISHING MEDIA: Carbon dioxide, foam, or dry chemical.
SPECIAL FIRE FIGHTING INSTRUCTION AND EQUIPMENT: Wear self-contained breathing apparatus and full protective clothing. Keep fire exposed cylinders cool with water spray. If possible, stop the product flow.
HAZARDOUS COMBUSTION PRODUCTS: Toxic carbon monoxide, hydrogen chloride and

phosgene.
UNUSUAL FIRE AND EXPLOSION HAZARDS:
Emits toxic fumes under fire conditions.
Cylinder rupture may occur under fire
conditions.

6. ACCIDENTAL RELEASE MEASURES

CLEAN UP PROCEDURES: Remove leaking cylinder to exhaust hood or safe outdoor area if this can be done safely. Evacuate and ventilate area. Use a self-contained breathing apparatus in case of emergency or non-routine use. Shut off source if possible and remove source of heat. Absorb with sand or vermiculite and place in closed containers for disposal.
SPECIALIZED EQUIPMENT: None

7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING: Secure cylinder when using to protect from falling. Use suitable hand truck to move cylinders. Use only in a well-ventilated area.
PRECAUTIONS TO BE TAKEN IN STORAGE:
Store in well ventilated areas. Keep
valve protection cap on cylinders when
not in use. Store away from heat, flame,
and sparks.

8. EXPOSURE CONTROLS/ PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide adequate general and local exhaust ventilation to maintain concentrations below exposure and flammable limits.

PERSONAL PROTECTION

EYE/FACE PROTECTION: Goggles.
SKIN PROTECTION: Impervious gloves,
coveralls, boots, and/or other resistant
protective clothing.
RESPIRATORY PROTECTION: Use a
self-contained breathing apparatus in
case of emergency or non-routine use.
OTHER PROTECTIVE EQUIPMENT: Safety shoes
when handling cylinders.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Colorless
ODOR: Sweet ether-like odor.
PHYSICAL STATE: Liquid
VAPOR PRESSURE: @20 deg.C: 58 mm Hg
VAPOR DENSITY (AIR=1): 4.54
BOILING POINT (C): 87
SOLUBILITY IN WATER: @25 deg.C: 0.1%
SPECIFIC GRAVITY (H2O=1): @20 deg.C:
1.464
EVAPORATION RATE: (CCl4=1): 0.69
ODOR THRESHOLD: 82 to 108 ppm

10. STABILITY AND REACTIVITY

STABILITY: Stable under normal storage conditions.
CONDITIONS TO AVOID: Storage in poorly ventilated areas. Storage near a heat source. Exposure to light, moisture, and ignition sources.
MATERIALS TO AVOID: Powdered alkali or alkaline earth metals, strong oxidizing agents.
HAZARDOUS POLYMERIZATION: Will not occur.
HAZARDOUS DECOMPOSITION: HCl gas, phosgene gas, CO and oxides of chlorine.

11. TOXICOLOGICAL INFORMATION

LETHAL CONCENTRATION (LC50): NONE ESTABLISHED
LETHAL DOSE 50 (LD50): N/Ap
TERATOGENICITY: N/Ap
REPRODUCTIVE EFFECTS: N/Ap
MUTAGENICITY: N/Ap

12. ECOLOGICAL INFORMATION

No adverse ecological effects are expected.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Dispose of non-refillable cylinders in accordance with

federal, state and local regulations. Allow gas to vent slowly to atmosphere in an unconfined area or exhaust hood. If the cylinders are the refillable type, return cylinders to supplier with any valve outlet plugs or caps secured and valve protection caps in place. Waste can be burned in an approved incinerator equipped with an afterburner and scrubber.

14. TRANSPORT INFORMATION

CONCENTRATION: 99+%

DOT DESCRIPTION (US ONLY):

PROPER SHIPPING NAME: Trichloroethylene

HAZARD CLASS: 6.1 (poison), Packing group III

IDENTIFICATION NUMBER: UN1710

REPORTABLE QUANTITIES: 100 lb.

LABELING: KEEP AWAY FROM FOOD

ADR/RID (EU Only): Class 6.1, 15(c)

SPECIAL PRECAUTIONS: Cylinders should be transported in a secure upright position in a well ventilated truck.

15. REGULATORY INFORMATION

OSHA: Process Safety Management: Material is not listed in appendix A of 29 CFR 1910.119 as highly hazardous chemical.

TSCA: Material is listed in TSCA inventory.

SARA: The threshold planning quantity for material is 10,000 lbs.

EU NUMBER: 201-167-4

NUMBER IN ANNEX 1 OF DIR 67/548: Material is listed in annex 1.

EU CLASSIFICATION: N/Av

R: 40

S: 23-36/37

16. OTHER INFORMATION

OTHER PRECAUTIONS: Protect containers from physical damage. Do not deface cylinders or labels. Cylinders should be refilled by qualified producers of

compressed gas. Shipment of a compressed gas cylinder which has not been filled by the owner or with his written consent is a violation of federal law (49 CFR).

ABBREVIATIONS:
N/Ap - Not Applicable
N/Av - Not Available
SA - Simple Asphyxiant
NE - None Established

MATERIAL SAFETY DATA SHEETS
156-59-2/E-1

DATE: 29Apr2011

SUPPLIER ADDRESS: 6141 EASTON RD
PO BOX 310
PLUMSTEADVILLE, PA 18949-0310

EMERGENCY PHONE NUMBER: (215) 766-8860

1. CHEMICAL PRODUCT

PRODUCT NAME: 1,2-DICHLOROETHYLENE (CIS)

SYNONYMS: cis-Dichloroethylene

2. COMPOSITION, INFORMATION ON INGREDIENTS

Ingredient Name	Formula	CAS#	Concentration	Exposure Limits (PPM) TLV	OSHA PEL	Other ACGIH MAC	STEL
1,2-DICHLOROETHYLENE (CIS	C2H2CL2	156-59-2	99+%	200	NE	NE	NE

Note: NE = NONE ESTABLISHED

3. HAZARD IDENTIFICATION

*** EMERGENCY OVERVIEW ***

Flammable liquid and vapor.
Can form explosive mixtures with air.
Can cause irritation to eyes, skin and respiratory tract.

POTENTIAL HEALTH EFFECTS
ROUTES OF ENTRY: Inhalation , Ingestion
ACUTE EFFECTS: Vapor or mist is irritating to the eyes, skin, mucous membrane, and upper respiratory tract. Skin and eye irritation may occur. High concentrations may have a narcotic effect.
CHRONIC EFFECTS: Kidney and liver damage.
MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None known
OTHER EFFECTS OF OVEREXPOSURE: None
CARCINOGENICITY (US Only):
NTP - No
IARC MONOGRAPHS - No
OSHA REGULATED - No

4. FIRST AID MEASURES

INHALATION: Immediately remove victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.

EYE CONTACT: Immediately flush with copious amounts of water for at least 15 minutes.

SKIN CONTACT: Immediately flush with copious amounts of water for at least 15 minutes while removing contaminated clothing.

INGESTION: Never give anything by mouth to an unconscious person. Have conscious and alert person drink 1 to 2 glasses of water. Induce vomiting after victim drinks water.

IN EVENT OF EXPOSURE, CONSULT A PHYSICIA

NOTE TO PHYSICIAN: None

5. FIRE FIGHTING MEASURES

FLASH POINT: 2 deg.C

AUTOIGNITION TEMPERATURE: 460 deg. C

FLAMMABLE LIMITS: Vol.%

LOWER: 5.6

UPPER: 12.80

EXTINGUISHING MEDIA: Carbon dioxide, foam, or dry chemical.

SPECIAL FIRE FIGHTING INSTRUCTION AND EQUIPMENT: Wear self-contained breathing apparatus and full protective clothing. Keep fire exposed cylinders cool with water spray.

HAZARDOUS COMBUSTION PRODUCTS: Toxic carbon monoxide, hydrogen chloride and phosgene.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Cylinder rupture may occur under fire conditions. Emits toxic fumes under fire conditions. Vapors may travel a considerable distance to the source of ignition and flash back.

6. ACCIDENTAL RELEASE MEASURES

CLEAN UP PROCEDURES: Evacuate and ventilate area. Remove leaking cylinder to

exhaust hood or safe outdoor area. Shut off source if possible and remove source of heat. Absorb with sand or vermiculite and place in closed containers for disposal.

SPECIALIZED EQUIPMENT: None

7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING: Secure cylinder when using to protect from falling. Use suitable hand truck to move cylinders. Use only in a well-ventilated area.

PRECAUTIONS TO BE TAKEN IN STORAGE:
Store in well ventilated areas. Keep valve protection cap on cylinders when not in use. Store away from oxidizers, combustible materials, and source of ignition or heat.

8. EXPOSURE CONTROLS/ PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide adequate general and local exhaust ventilation to maintain concentrations below exposure and flammable limits.

PERSONAL PROTECTION

EYE/FACE PROTECTION: Goggles. A safety shower and eyewash station should be readily available.
SKIN PROTECTION: Wear suitable protective clothing.
RESPIRATORY PROTECTION: Use a self-contained breathing apparatus in case of emergency or non-routine use.
OTHER PROTECTIVE EQUIPMENT: Safety shoes when handling cylinders.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Colorless
ODOR: Pleasant aromatic odor
PHYSICAL STATE: Liquid
VAPOR PRESSURE: @41 deg.C: 400 mm Hg
VAPOR DENSITY (AIR=1): 3.34
BOILING POINT (C): 59
SOLUBILITY IN WATER: Insoluble
SPECIFIC GRAVITY (H2O=1): @20 deg.C:

1.284
EVAPORATION RATE: N/Av
ODOR THRESHOLD: N/Av

10. STABILITY AND REACTIVITY

STABILITY: Stable under normal storage conditions.
CONDITIONS TO AVOID: Storage in poorly ventilated areas. Storage near a heat source.
MATERIALS TO AVOID: Oxidizing agents, air and moisture. Nitrogen dioxide, sodium, potassium hydroxide.
HAZARDOUS POLYMERIZATION: Will not occur.
HAZARDOUS DECOMPOSITION: HCl gas, phosgene gas, CO and oxides of chlorine.

11. TOXICOLOGICAL INFORMATION

LETHAL CONCENTRATION (LC50): None established
LETHAL DOSE 50 (LD50): N/Ap
TERATOGENICITY: N/Ap
REPRODUCTIVE EFFECTS: N/Ap
MUTAGENICITY: N/Ap

12. ECOLOGICAL INFORMATION

No adverse ecological effects are expected.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Dispose of non-refillable cylinders in accordance with federal, state and local regulations. Allow gas to vent slowly to atmosphere in an unconfined area or exhaust hood. If the cylinders are the refillable type, return cylinders to supplier with any valve outlet plugs or caps secured and valve protection caps in place. Waste can be burned in an approved incinerator equipped with an afterburner and scrubber.

14. TRANSPORT INFORMATION

CONCENTRATION: 99+%
DOT DESCRIPTION (US ONLY):
PROPER SHIPPING NAME: Flammable liquids, n.o.s.
HAZARD CLASS: 3 (flammable), Packing Group I
IDENTIFICATION NUMBER: UN1993
REPORTABLE QUANTITIES: 1000 lb.
LABELING: FLAMMABLE LIQUID
ADR/RID (EU Only): Class 3, 3(b)
SPECIAL PRECAUTIONS: Cylinders should be transported in a secure upright position in a well ventilated truck.

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15. REGULATORY INFORMATION

OSHA: Process Safety Management: Material is not listed in appendix A of 29 CFR 1910.119 as highly hazardous chemical.
TSCA: Material is listed in TSCA inventory.
SARA: The threshold planning quantity for material is 10,000 lbs.
EU NUMBER: N/Av
NUMBER IN ANNEX 1 OF DIR 67/548: Material is listed in annex 1.
EU CLASSIFICATION: N/Av
R: 22-33-35-64
S: 15-22-23-27-36-65-71-76-104

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16. OTHER INFORMATION

OTHER PRECAUTIONS: Protect containers from physical damage. Do not deface cylinders or labels. Cylinders should be refilled by qualified producers of compressed gas. Shipment of a compressed gas cylinder which has not been filled by the owner or with his written consent is a violation of federal law (49 CFR).

ABBREVIATIONS:
N/Ap - Not Applicable
N/Av - Not Available
SA - Simple Asphyxiant
NE - None Established

DISCLAIMER: Information included in this document is given to the best of our knowledge, however, no warranty is made

MATERIAL SAFETY DATA SHEETS
156-60-5/E-1

DATE: 29Apr2011

SUPPLIER ADDRESS: 6141 EASTON RD
PO BOX 310
PLUMSTEADVILLE, PA 18949-0310
EMERGENCY PHONE NUMBER: (215) 766-8860

1. CHEMICAL PRODUCT

PRODUCT NAME: 1,2-DICHLOROETHYLENE (TRANS)
SYNONYMS: trans-Acetylene dichloride.

2. COMPOSITION, INFORMATION ON INGREDIENTS

Ingredient Name	Formula	CAS#	Concentration	Exposure Limits (PPM) TLV	OSHA PEL	ACGIH MAC	Other STEL
1,2-DICHLOROETHYLENE (TRA	C2H2CL2	156-60-5	99+%	200	200	200	NE

Note: NE = NONE ESTABLISHED

3. HAZARD IDENTIFICATION

*** EMERGENCY OVERVIEW ***
Flammable liquid and vapor.
May cause irritation to eyes, skin, and mucous membranes.

POTENTIAL HEALTH EFFECTS
ROUTES OF ENTRY: Inhalation
ACUTE EFFECTS: Vapor or mist is irritating to the eyes, skin, mucous membranes, and upper respiratory tract. This material is narcotic in high concentrations.
CHRONIC EFFECTS: None known
MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None known
OTHER EFFECTS OF OVEREXPOSURE: None
CARCINOGENICITY (US Only):
NTP - No
IARC MONOGRAPHS - No
OSHA REGULATED - No

4. FIRST AID MEASURES

INHALATION: Immediately remove victim to fresh air. If breathing is difficult, give oxygen. If breathing has stopped, give artificial respiration.

EYE CONTACT: Immediately flush with copious amounts of water for at least 15 minutes.

SKIN CONTACT: Immediately flush with copious amounts of water for at least 15 minutes while removing contaminated clothing.

INGESTION: Never give anything by mouth to an unconscious person. Contact a poison control center.

IN EVENT OF EXPOSURE, CONSULT A PHYSICIA

NOTE TO PHYSICIAN: None

---

5. FIRE FIGHTING MEASURES

FLASH POINT: 19.8 deg. C

AUTOIGNITION TEMPERATURE: N/Av

FLAMMABLE LIMITS:

LOWER: 9.7

UPPER: 12.8

EXTINGUISHING MEDIA: Dry chemical powder, carbon dioxide, or alcohol or polymer foam. Water spray.

SPECIAL FIRE FIGHTING INSTRUCTION AND EQUIPMENT: Wear self-contained breathing apparatus and full protective clothing. Keep fire exposed cylinders cool with water spray.

HAZARDOUS COMBUSTION PRODUCTS: Toxic carbon monoxide, hydrogen chloride and phosgene.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Emits toxic fumes under fire conditions. Vapors may travel a considerable distance to the source of ignition and flash back.

---

6. ACCIDENTAL RELEASE MEASURES

CLEAN UP PROCEDURES: Evacuate and ventilate area. Remove all sources of ignition. Absorb with sand or vermiculite and place in closed containers for disposal.

SPECIALIZED EQUIPMENT: None

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7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING: Secure cylinder when using to protect from falling. Use suitable hand truck to move cylinders.

PRECAUTIONS TO BE TAKEN IN STORAGE:
Store in well ventilated areas. Keep valve protection cap on cylinders when not in use.

---

8. EXPOSURE CONTROLS/ PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide adequate general and local exhaust ventilation to maintain concentrations below exposure and flammable limits.

PERSONAL PROTECTION

EYE/FACE PROTECTION: Goggles. A safety shower and eyewash station should be readily available.
SKIN PROTECTION: Wear suitable protective clothing.
RESPIRATORY PROTECTION: Use a self-contained breathing apparatus in case of emergency or non-routine use.
OTHER PROTECTIVE EQUIPMENT: Safety shoes when handling cylinders.

---

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Colorless
ODOR: Pleasant aromatic odor
PHYSICAL STATE: Liquid
VAPOR PRESSURE: @20 deg. C: 295 mm Hg
VAPOR DENSITY (AIR=1): 3.3
BOILING POINT (C): 48
SOLUBILITY IN WATER: Insoluble
SPECIFIC GRAVITY (H2O=1): 1.257
EVAPORATION RATE: N/Av
ODOR THRESHOLD: N/Av

---

10. STABILITY AND REACTIVITY

STABILITY: Stable under normal storage conditions.
CONDITIONS TO AVOID: Sparks, flame, heat

and other sources of ignition.
MATERIALS TO AVOID: Oxidizing agents.
HAZARDOUS POLYMERIZATION: Will not occur.
HAZARDOUS DECOMPOSITION: HCl gas, phosgene gas, CO and oxides of chlorine.

11. TOXICOLOGICAL INFORMATION

LETHAL CONCENTRATION (LC50): NONE ESTABLISHED
LETHAL DOSE 50 (LD50): N/Ap
TERATOGENICITY: N/Ap
REPRODUCTIVE EFFECTS: N/Ap
MUTAGENICITY: N/Ap

12. ECOLOGICAL INFORMATION

No adverse ecological effects are expected.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Dispose of non-refillable cylinders in accordance with federal, state and local regulations. Allow gas to vent slowly to atmosphere in an unconfined area or exhaust hood. If the cylinders are the refillable type, return cylinders to supplier with any valve outlet plugs or caps secured and valve protection caps in place. Waste can be burned in an approved incinerator equipped with an afterburner and scrubber.

14. TRANSPORT INFORMATION

CONCENTRATION: 99+%
DOT DESCRIPTION (US ONLY):
PROPER SHIPPING NAME: Dichloroethylene
HAZARD CLASS: 3 (flammable), Packing group II.
IDENTIFICATION NUMBER: UN1150
REPORTABLE QUANTITIES: 1000 lbs
LABELING: FLAMMABLE LIQUID
ADR/RID (EU Only): Class 3, 3(b)
SPECIAL PRECAUTIONS: Cylinders should be transported in a secure upright position

in a well ventilated truck.

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15. REGULATORY INFORMATION

OSHA: Process Safety Management: Material is not listed in appendix A of 29 CFR 1910.119 as highly hazardous chemical.

TSCA: Material is listed in TSCA inventory.

SARA: The threshold planning quantity for material is 10,000 lbs.

EU NUMBER: N/Av

NUMBER IN ANNEX 1 OF DIR 67/548: Not listed in annex 1.

EU CLASSIFICATION: N/Av

R: N/Av

S: N/Av

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16. OTHER INFORMATION

OTHER PRECAUTIONS: Protect containers from physical damage. Do not deface cylinders or labels. Cylinders should be refilled by qualified producers of compressed gas. Shipment of a compressed gas cylinder which has not been filled by the owner or with his written consent is a violation of federal law (49 CFR).

ABBREVIATIONS:

N/Ap - Not Applicable

N/Av - Not Available

SA - Simple Asphyxiant

NE - None Established

DISCLAIMER: Information included in this document is given to the best of our knowledge, however, no warranty is made that the information is accurate or complete. We do not accept any responsibility for damages by the use of the document.

MATERIAL SAFETY DATA SHEETS
75-01-4/E-5

DATE: 29Apr2011

SUPPLIER ADDRESS: 6141 EASTON RD
PO BOX 310
PLUMSTEADVILLE, PA 18949-0310
EMERGENCY PHONE NUMBER: (215) 766-8860

1. CHEMICAL PRODUCT

PRODUCT NAME: VINYL CHLORIDE

SYNONYMS: VCM, Chloroethylene, chloroethane

2. COMPOSITION, INFORMATION ON INGREDIENTS

Ingredient Name	Formula	CAS#	Concentration	Exposure Limits (PPM) ACGIH TLV	OSHA PEL	Other MAC	Other STEL
VINYL CHLORIDE	C2H3Cl	75-01-4	99+%	5	1	NE	5

Note: NE = NONE ESTABLISHED

3. HAZARD IDENTIFICATION

*** EMERGENCY OVERVIEW ***

Flammable liquid and gas under pressure.
Can cause cancer.
Can form explosive mixtures with air.
May cause liver, kidney, spleen, and other organ damage.
May cause irritation to eyes, skin and mucous membranes.
May cause frostbite.

POTENTIAL HEALTH EFFECTS

ROUTES OF ENTRY: Inhalation

ACUTE EFFECTS: Vapor inhalation causes varying degrees of central nervous system depression with noticeable anesthetic effects at levels of 1% (10,000 ppm). Inhalation can cause headache, dizziness, lung irritation, narcosis and unconsciousness. Pressure drop through valves and piping may cause extreme cold and frostbite on contact.

CHRONIC EFFECTS: Liver tumors (angiosarcomas) are formed from vinyl chloride exposure. Other tumors of the central nervous system, respiratory system, blood and lumphatic system occured from exposure to the polyvinyl chloride manufacture process but vinyl chloride itself may not be the causative agent.
MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None known
OTHER EFFECTS OF OVEREXPOSURE: None
CARCINOGENICITY (US Only):
NTP - Yes
IARC MONOGRAPHS - Yes
OSHA REGULATED - Yes

4. FIRST AID MEASURES

INHALATION: Immediately remove victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.
EYE CONTACT: Immediately flush with copious amounts of water for at least 15 minutes.
SKIN CONTACT: If frostbite occurs, flush affected areas with lukewarm water.
INGESTION: None
IN EVENT OF EXPOSURE, CONSULT A PHYSICIA
NOTE TO PHYSICIAN: None

5. FIRE FIGHTING MEASURES

FLASH POINT: -78 deg. C
AUTOIGNITION TEMPERATURE: 472 deg. C
FLAMMABLE LIMITS: Vol.%
LOWER: 3.6
UPPER: 33
EXTINGUISHING MEDIA: Dry chemical, carbon dioxide, or halogenated gas.
SPECIAL FIRE FIGHTING INSTRUCTION AND EQUIPMENT: Wear self-contained breathing apparatus and full protective clothing. Keep fire exposed cylinders cool with water spray.
HAZARDOUS COMBUSTION PRODUCTS: Toxic carbon monoxide and hydrogen chloride may be given off.
UNUSUAL FIRE AND EXPLOSION HAZARDS: Cylinder rupture may occur under fire conditions. May form explosive mixture in air.

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6. ACCIDENTAL RELEASE MEASURES

CLEAN UP PROCEDURES: Evacuate and ventilate area. Shut off source if possible and remove source of heat.

SPECIALIZED EQUIPMENT: None

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7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING: Secure cylinder when using to protect from falling. Use suitable hand truck to move cylinders.

PRECAUTIONS TO BE TAKEN IN STORAGE:
Store in well ventilated areas. Keep valve protection cap on cylinders when not in use.

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8. EXPOSURE CONTROLS/ PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide adequate general and local exhaust ventilation to maintain concentrations below exposure and flammable limits.

PERSONAL PROTECTION

EYE/FACE PROTECTION: Safety glasses

SKIN PROTECTION: None

RESPIRATORY PROTECTION: In case of leakage, use self-contained breathing apparatus.

OTHER PROTECTIVE EQUIPMENT: Safety shoes when handling cylinders.

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9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Colorless

ODOR: Sweet odor.

PHYSICAL STATE: Gas

VAPOR PRESSURE: @20 deg.C: 2530 mm Hg

VAPOR DENSITY (AIR=1): 2.2

BOILING POINT (C): -13.9

SOLUBILITY IN WATER: Slight

SPECIFIC GRAVITY (H2O=1): @20 deg.C: 0.9106

EVAPORATION RATE: Gas

ODOR THRESHOLD: 2000 ppm

10. STABILITY AND REACTIVITY

STABILITY: Stable under normal storage conditions.
CONDITIONS TO AVOID: Storage in poorly ventilated areas. Storage near a heat source. Exposure to air, heat, light and moisture.
MATERIALS TO AVOID: Copper, aluminum and certain catalytic impurities. It can form peroxides by catalyzed oxidation with atmospheric oxygen. Oxidizing agents.
HAZARDOUS POLYMERIZATION: May occur.
HAZARDOUS DECOMPOSITION: Toxic carbon monoxide and hydrogen chloride.

11. TOXICOLOGICAL INFORMATION

LETHAL CONCENTRATION (LC50): >5000 ppm, Rat 1 hour
LETHAL DOSE 50 (LD50): N/Ap
TERATOGENICITY: N/Ap
REPRODUCTIVE EFFECTS: N/Ap
MUTAGENICITY: N/Ap

12. ECOLOGICAL INFORMATION

No adverse ecological effects are expected.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Dispose of non-refillable cylinders in accordance with federal, state and local regulations. Allow gas to vent slowly to atmosphere in an unconfined area or exhaust hood. If the cylinders are the refillable type, return cylinders to supplier with any valve outlet plugs or caps secured and valve protection caps in place. Waste can be burned in an approved incinerator equipped with an afterburner and scrubber.

14. TRANSPORT INFORMATION

CONCENTRATION: 99+%
DOT DESCRIPTION (US ONLY):
PROPER SHIPPING NAME: Vinyl chloride, inhibited
HAZARD CLASS: 2.1 (flammable)
IDENTIFICATION NUMBER: UN1086
REPORTABLE QUANTITIES: 1 lb.
LABELING: FLAMMABLE GAS
ADR/RID (EU Only): Class 2, 2F
SPECIAL PRECAUTIONS: Cylinders should be transported in a secure upright position in a well ventilated truck.

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15. REGULATORY INFORMATION

OSHA: Process Safety Management: Material is not listed in appendix A of 29 CFR 1910.119 as highly hazardous chemical.
TSCA: Material is listed in TSCA inventory.
SARA: The threshold planning quantity for material is 10,000 lbs.
EU NUMBER: 200-831-0
NUMBER IN ANNEX 1 OF DIR 67/548: Not listed in annex 1.
EU CLASSIFICATION: N/Av
R: 45,13
S: 53,9,16,44

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16. OTHER INFORMATION

OTHER PRECAUTIONS: Protect containers from physical damage. Do not deface cylinders or labels. Cylinders should be refilled by qualified producers of compressed gas. Shipment of a compressed gas cylinder which has not been filled by the owner or with his written consent is a violation of federal law (49 CFR).
ABBREVIATIONS:
N/Ap - Not Applicable
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Physical Agent Data Sheet (PADS)

Noise

Description

Sound is created when a vibrating source (like a bell, motor or a stereo speaker) sends sound waves through the air to your ear. Every sound has two aspects: its pitch (frequency) and its loudness (intensity). On a stereo, frequency is determined by the bass/treble control. Intensity is determined by the volume control. Noise (unwanted sound) is usually made up of many frequencies. The disturbing and harmful effects of noise depend both on the loudness and the frequency of the tones making up noise.

Loudness is measured in units called decibels (dB). A conversational voice is about 65 dB. A shout is 90 dB or greater.

Frequency is measured in units called Hertz (Hz). The frequency of a locomotive horn is about 250 Hz. The frequency of a table saw is about 4,000 Hz.

Health Effects

Excessive noise can destroy the ability to hear, and may also put stress of other parts of the body, including the heart.

For most effects of noise, there is no cure, so that prevention of excessive noise exposure is the only way to avoid health damage.

Hearing

The damage done by noise depends mainly on how loud it is and on the length of exposure. The frequency or pitch can also have some effect, since high-pitched sounds are more damaging than low-pitched sounds.

Noise may tire out the inner ear, causing temporary hearing loss. After a period of time away from the noise hearing may be restored. Some workers who suffer temporary hearing loss may find that by the time their hearing returns to normal, it is time for another work shift so, in that sense, the problem is "permanent."

With continual noise exposure, the ear will lose its ability to recover from temporary hearing loss, and the damage will become permanent. Permanent hearing loss results from the destruction of cells in the inner ear, cells which can never be replaced or repaired. Such damage can be caused by long-term exposure to loud noise or, in some cases" by brief exposures to very loud noises.

Normally, workplace noise first affects the ability to hear high frequency (high-pitched) sounds. This means that even though a person can still hear some noise, speech or other sounds may be unclear or distorted.

Workers suffering from noise-induced hearing loss may also experience continual ringing in their ears,

called "tinnitus." At this time, there is no cure for tinnitus, although some doctors are experimenting with treatment.

Other Effects

Although research on the effects of noise is not complete, it appears that noise can cause quickened pulse rate, increased blood pressure and a narrowing of the blood vessels over a long period of time, these may place an added burden on the heart.

Noise may also put stress on other parts of the body by causing the abnormal secretion of hormones and tensing of the muscles.

Workers exposed to noise sometimes complain of nervousness, sleeplessness and fatigue. Excessive noise exposure also can reduce job performance and may cause high rates of absenteeism.

Permissible Exposure Limit

The Action level for noise is an average noise level of 85 dB for an eight-hour day. When employees are exposed to noise levels, which exceed the Permissible Exposure Limit, the employer must install or use engineering or administrative controls to lower the noise levels. While these controls are being designed or installed employees must wear hearing protection. If the controls still do not reduce noise exposures to below 90 dB, hearing protection must continue to be worn.

Protective Measures

Suitable hearing protectors (earplugs or muffs) must be made available at no cost to employees who are exposed to an average of 85 dB or greater for an eight-hour day. Employees must be given the opportunity to select from three different types of appropriate hearing protectors.

Hearing tests (audiometric exams) must be given to employees who are exposed to an average of 85 dB or greater for an eight-hour day. Hearing tests will show whether employees are experiencing any hearing losses. Hearing tests are also useful in showing how well the earplugs and earmuffs are working. Hearing tests must be given annually.

Employees should also receive training in the effects of noise on hearing, an explanation of the hearing tests, and instruction on the proper fitting and care of earplugs or muffs.

Noise away from work can also cause hearing loss. Hearing protectors should be worn when operating noisy equipment or tools such as chain saws, brush cutters, power lawn mowers, or when using firearms.

Refer to Alaska Administrative Code, Occupational Health and Environmental Control 04.0104 for specific regulations on Noise Exposure and Hearing Conservation Programs.

Physical Agent Data Sheet (PADS)

Cold Stress

Exposure to cold can cause the body's internal temperature to drop to a dangerously low level. This is called hypothermia. Exposure to temperatures below freezing can cause frostbite of the hands, feet, and face.

Hypothermia Can Kill

Hypothermia occurs when a person's body loses heat faster than it can be produced. The body's "normal" deep body temperature is 99.6 degrees Fahrenheit. . If your body temperature drops to 95 degrees Fahrenheit, uncontrollable shivering occurs. If cooling continues, these other symptoms may occur:

Vague, slow, slurred speech

Forgetfulness, memory lapses

Inability to use hands

Frequent stumbling

Drowsiness

Exhaustion, collapse

Unconsciousness

Death

Hypothermia impairs your judgment. You may not be able to make good decisions about your situation. Preventing hypothermia is the best way to avoid being a victim.

Preventing Hypothermia: Be Prepared

Hypothermia can occur at temperatures above freezing. Cold, wet, windy conditions make prime hypothermia weather.

Stay Dry - Avoid Exposure

Wet clothing draws heat very quickly away from the body. Whenever you may be away from shelter or your vehicle, carry waterproof, windproof outer clothing. Put this clothing on before you get wet. Wear inner clothing which retains warmth even when it's wet, such as wool or polypropylene. Avoid cotton clothing. Down clothing is good for cold, dry weather but it loses almost all insulating value if it gets wet. Wear layers of clothing which may be removed or put back on depending on the degree of physical activity. Being wet from sweat is just as dangerous as being wet from rain or snow.

Terminate Exposure

If you do not have adequate clothing to stay warm and dry, get out of the wind and rain or snow. Return to shelter or make camp while you still have a reserve of energy. Build a fire. Make your camp as secure and as comfortable as possible.

Treatment of Hypothermia

Be able to recognize the symptoms of hypothermia in yourself and others. The victim may deny he/she is in trouble. Even mild symptoms demand attention.

1. Get the victim out of wet and windy weather.
2. Remove all wet clothing.
3. If the person is only mildly affected:

    a. Give warm drinks

    b. Put into dry clothing and a warm sleeping bag.

If more seriously affected (very clumsy, confused, unable to shiver):

1. Treat very gently.
2. Place the victim naked into a warm sleeping bag.
3. Place a rescuer, also naked, into the same sleeping bag. If you have a double bag, place the victim between two rescuers. Warmth from skin to skin contact is the safest method of rewarming. Any warm objects such as rocks, hot water bottles, or heat packs should be wrapped in towels or clothing. Arrange for evacuation. Do not give warm drinks until the victim has regained a clear level of consciousness, the ability to swallow, and is already starting to warm up.

Frostbite[1]

Frostbite is the freezing of some part of the body. Fingers, toes, and even whole arms and legs can be lost as a result of frostbite. Such injuries have happened in cities and villages as well as in more isolated areas of Alaska.

Protection From the Cold

In extreme cold it is important to prevent heat loss from as many areas of the body as possible. Exposed limbs and head are major areas of heat loss, but keeping enough blood flowing to the hands and feet is the key to preventing frostbite. The trunk and the head, then, should be warm enough so that the brain is able to command the blood vessels in the hands and feet to open up.

Essential Clothing

This includes thermal underwear, insulated footwear or mukluks with liners, double mittens and a parka, preferably down-filled with a good ruff. A parka which can be opened at the neck to allow heat to escape will prevent overheating and sweating. Quilted or skin pants are necessary if no warm shelter is immediately available. Tight clothes, especially tight gloves or tight boots, should not be worn. They interfere with the blood flow and reduce insulation against the cold.

Traveling

The traveler, even on a snowmobile, or in a heated automobile, should always be prepared to walk in severe cold. This means carrying along proper clothing and more extensive survival gear. If an accident, mechanical breakdown, or other interruption occurs during travel, the clothes you have must provide enough warmth to sustain life. Hands and feet should be well protected at all times to hinder the development of frostbite until help arrives.

Some Special Warnings

Don't touch cold metal with bare or wet hands. You will freeze to the metal and tear away skin. If necessary, thaw gently with heat, warm water or urine.

Be careful when handling gasoline, kerosene or liquids other than water. Contact at cold temperatures can cause immediate frostbite.

Remember that frostbite is more likely to occur when you are injured, frightened or careless.

Other Factors Leading to Frostbite

Tall thin persons are more likely to get frostbite than those of stocky build.

People in poor physical condition are more susceptible than those in good health.

Certain diseases slow down the blood flow in the hands and feet, especially in elderly people, and encourage frostbite.

Heavy smokers often have poor circulation in the vital organs and to the arms and legs, and are also susceptible.

Children and elderly people, unable to produce large amounts of body heat for long periods of time, may experience a lowering of deep body temperature and, ultimately, frostbite.

Alcohol causes the blood vessels to dilate (become larger). This lends a sense of warmth, but it also insures a faster loss of body heat. More important, people act with poor judgement after drinking.

In short, poor circulation and poor production of body heat will lower resistance to frostbite.

How to Recognize Frostbite

Pain in the hands and feet is felt only when the temperature of the tissue is changing very rapidly. There may be no pain with gradual freezing.

Loss of the sensations of touch, pressure, and pain may occur without awareness of any numbness or other sensation. Therefore, it is important to test these sensations often and to wear clothing that is loose and does not restrict the flow of blood to the limbs.

Exposed parts of the body should be inspected routinely. This is done best by a partner. Just before freezing, the skin, especially the face with its many blood vessels, becomes bright red. Then small patches of white appear, as freezing actually occurs.

The skin also becomes less elastic. This is best noted in the finger pads, which remain pitted when touched or squeezed. Any further cooling will surely result in frostbite.

Serious freezing is most common in the feet because of less awareness of them, poor circulation and sensation, and inadequate foot gear. Hands are next in order of serious injury. Exposed head parts are less likely to become frostbitten than feet because they are conditioned to exposure and have a better blood supply.

Early Treatment of Frostbite: Proper Rewarming

1. Next to the extent of freezing, inadequate or improper treatment of a frozen part is the most common cause of serious loss of tissue.
2. In many cases rewarming cannot be done without the part again becoming frozen. For example, removing clothing from other parts of the body to warm a frozen part may only result in the loss of more body heat, greater extent of injury, and the ultimate refreezing of the afflicted part.

   Thawing and refreezing should aways be avoided. It is best to continue, even if it means walking on a frozen foot, until shelter is available and rewarming can be. done satisfactorily.
3. Limbs should be rewarmed in stirred water just above normal body temperature (about 100 - 105 degrees Fahrenheit). Using a thermometer is the only accurate way to measure this temperature. Never try to thaw in cold water or snow. Since feeling is lost, fires, stoves, exhaust pipes, etc., should never be used. Serious damage to the tissue could result.
4. If the major part of the limb is frozen when rewarming is started, deep body temperature will fall as the cooled blood begins to flow throughout the body. To prevent such cooling, warm liquids by mouth should be given. Even total immersion of the body in a warm bath may be necessary.
5. Rewarming is an acutely painful experience and medication to alleviate pain should be given if available. After thawing, a deep aching pain may persist for several days, depending upon severity of the injury. Pain is actually a good sign, since it indicates that nerve function is still present.
6. The afflicted part should be moved gently and voluntarily during rewarming.
7. A dull purple color indicates more serious injury and requires medical attention. So does swelling or blisters. Other means for improving circulation are available but must be administered by medical personnel.

Summary

Most cases of frostbite occur as a result of lack of knowledge, careless preparation, unavoidable accident, or the effects of alcohol on judgement. Intelligent forethought can prevent injury.

If freezing does occur, proper rewarming in warm water will give maximum benefit. The injured limb should be handled gently and a medical judgement be made of the extent of the injury and the need for further treatment.

Reference

1. Frostbite information compiled and distributed by the Providence Hospital Thermal Unit.

Physical Agent Data Sheet (PADS)

Heat Stress

Description

Heat stress is caused by working in hot environments like laundries, bakeries, or around boilers or incinerators. Four environmental factors affect the amount of heat stress felt by employees in hot work areas: temperature, humidity, radiant heat (such as from the sun or a furnace), and air velocity. How well or how poorly an individual reacts to heat stress is dependent on personal characteristics such as age, weight, fitness, medical condition, and acclimatization.

The body has several methods of maintaining the proper internal body temperature. When internal body temperature increases, the circulatory system reacts by increasing the amount of blood flow to the skin so the extra heat can by given off.

Sweating is another means the body uses to maintain stable internal temperatures. When sweat evaporates, cooling results. However, sweating is effective only if the humidity level is low enough to permit evaporation and if the fluids and salts lost are replaced.

Health Effects—Heat Disorders

Heat stroke, the most serious health problem for workers in hot environments is caused by the failure of the body's internal mechanism to regulate its core temperature. Sweating stops and the body can no longer rid itself of excess heat. Signs include: mental confusion, delirium, loss of consciousness, convulsions or coma; a body temperature of 106 degrees Fahrenheit or higher; and hot dry skin which may be red, mottled or bluish. Victims of heat stroke will die unless treated promptly. While medical help should be called, the victim must be removed immediately to a cool area and his/her clothing soaked with cool water. He/she should be fanned vigorously to increase cooling. Prompt first aid can prevent permanent injury to the brain and other vital organs.

Heat exhaustion develops as a result of loss of fluid through sweating when a worker has failed to drink enough fluids or take in enough salt, or both. The worker with heat exhaustion still sweats, but experiences extreme weakness or fatigue, giddiness, nausea, or headache. The skin is clammy and moist, the complexion pale or flushed, and the body temperature normal or slightly higher. Treatment is usually simple: the victim should rest in a cool place and drink salted liquids. Salt tablets are not recommended. Severe cases involving victims who vomit or lose consciousness may require longer treatment under medical supervision.

Heat cramps, painful spasms of the bone muscles, are caused when workers drink large quantities of water but fail to replace their bodies' salt loss. Tired muscles, those used for performing the work, are usually the ones most susceptible to cramps. Cramps may occur during or after working hours and may be relieved by taking salted liqids by mouth or saline solutions intravenously for quicker relief, if medically determined to be required.

Fainting may be a problem for the worker unacclimatized to a hot environment who simply stands still in

the heat. Victims usually recover quickly after a brief period of lying down. Moving around, rather that standing still, will usually reduce the possibility of fainting.

Heat rash, also known as prickly heat, may occur in hot and humid environments where sweat is not easily removed from the surface of the skin by evaporation. When extensive or complicated by infection, heat rash can be so uncomfortable that it inhibits sleep and impairs a worker's performance or even results in temporary total disability. It can be prevented by showering, resting in a cool place, and allowing the skin to dry.

Medical Conditions Aggravated By Exposure to Heat

Persons with heart or circulatory diseases or those who are on "low salt" diets should consult with their physicians prior to working in hot environments.

Preventing Heat Disorders

One of the best ways to reduce heat stress on workers is to minimize heat in the workplace. However, there are some work environments where heat production is difficult to control, such as when furnaces or sources of steam or water are present in the work area, or when the workplace itself is outdoors and exposed to varying warm weather conditions.

Acclimatization

Humans are, to a large extent, capable of adjusting to the heat. This adjustment to heat, under normal circumstances, usually takes about 5 to 7 days, during which time the body will undergo a series of changes that will make continued exposure to heat more endurable.

On the first day of work in a hot environment, the body temperature, pulse rate, and general discomfort will be higher. With each succeeding daily exposure, all of these responses will gradually decrease, while the sweat rate will increase. When the body becomes acclimated to the heat, the worker will find it possible to perform work with less strain and distress.

Gradual exposure to heat gives the body time to become accustomed to higher environmental temperatures. Heat disorders in general are more likely to occur among workers who have not been given time to adjust to working in the heat or among workers who have been away from hot environments and who have gotten accustomed to lower temperatures. Hot weather conditions of the summer are likely to affect the worker who is not acclimatized to heat. Likewise, workers who return to work after a leisurely vacation or extended illness may be affected by the heat in the work environment. Whenever such circumstances occur, the worker should be gradually reacclimatized to the hot environment.

Lessening Stressful Conditions

Many industries have attempted to reduce the hazards of heat stress by introducing engineering controls, training workers in the recognition and prevention of heat stress, and implementing work-rest cycles. Heat stress depends, in part, on the amount of heat the worker's body produces while a job is being performed. The amount of heat produced during hard, steady work is much higher than that produced during intermittent or light work. Therefore, one way of reducing the potential for heat stress is to make the job easier or lessen its duration by providing adequate rest time. Mechanization of work procedures

can often make it possible to isolate workers from the heat source (perhaps in an air-conditioned booth) and increase overall productivity by decreasing the time needed for rest. Another approach to reducing the level of heat stress is the use of engineering controls which include ventilation and heat shielding.

Number and Duration of Exposures

Rather than be exposed to heat for extended periods of time during the course of a job, workers should, wherever possible, be permitted to distribute the workload evenly over the day and incorporate work-rest cycles. Work-rest cycles give the body an opportunity to get rid of excess heat, slow down the production of internal body heat, and provide greater blood flow to the skin.

Workers employed outdoors are especially subject to weather changes. A hot spell or a rise in humidity can create overly stressful conditions. The following practices can help to reduce heat stress:

Postponement of nonessential tasks

Permit only those workers acclimatized to heat to perform the more strenuous tasks, or

Provide additional workers to perform the task keeping in mind that all workers should have the physical capacity to perform the task and that they should be accustomed to the heat.

Thermal Conditions in the Workplace

A variety of engineering controls can be introduced to minimize exposure to heat. For instance, improving the insulation on a furnace wall can reduce its surface temperature and the temperature of the area around it. In a laundry room, exhaust hoods installed over those sources releasing moisture will lower the humidity in the work area. In general, the simplest and least expensive methods of reducing heat and humidity can be accomplished by:

Opening windows in hot work areas,

Using fans, or

Using other methods of creating airflow such as exhaust ventilation or air blowers.

Rest Areas

Providing cool rest areas in hot work environments considerably reduces the stress of working in those environments. There is no conclusive information available on the ideal temperature for a rest area. However, a rest area with a temperature near 76 degrees Fahrenheit appears to be adequate and may even feel chilly to a hot, sweating worker, until acclimated to the cooler environment. The rest area should be as close to the workplace as possible. Individual work periods should not be lengthened in favor of prolonged rest periods. Shorter but frequent work-rest cycles are the greatest benefit to the worker.

Drinking Water

In the course of a day’s work in the heat, a worker may produce as much as 2 to 3 gallons of sweat. Because so many heat disorders involve excessive dehydration of the body, it is essential that water intake during the workday be about equal to the amount of sweat produced.

Most workers exposed to hot conditions drink less fluids than needed because of an insufficient thirst drive. A worker, therefore, should not depend on thirst to signal when and how much to drink. Instead, the worker should drink 5 to 7 ounces of fluids every 15 or 20 minutes to replenish the necessary fluids in the body. There is no optimum temperature of drinking water, but most people tend not to drink warm or very cold fluids as readily as they will cool ones. whatever the temperature of the water, it must be palatable and readily available to the worker. Individual drinking cups should be provided, never use a common drinking cup.

Heat acclimatized workers lose much less salt in their sweat than do workers who are not adjusted to the heat. The average American diet contains sufficient salt for acclimatized workers even when sweat production is high. If, for some reason, salt replacement is required, the best way to compensate for the loss is to add a little extra salt to the food. Salt tablets should not be used. CAUTION: PERSONS WITH HEART PROBLEMS OR THOSE ON A "LOW SODIUM" DIET WHO WORK IN HOT ENVIRONMENTS SHOULD CONSULT A PHYSICIAN ABOUT WHAT TO DO UNDER THESE CONDITIONS.

Protective Clothing

Clothing inhibits the transfer of heat between the body and the surrounding environment. Therefore, in hot jobs where the air temperature is lower than skin temperature, wearing clothing reduces the body's ability to lose heat into the air.

When air temperature is higher than skin temperature, clothing helps to prevent the transfer of heat from the air to the body. The advantage of wearing clothing, however, may be nullified if the clothes interfere with the evaporation of sweat.

In dry climates, adequate evaporation of sweat is seldom a problem. In a dry work environment with very high air temperatures, the wearing of clothing could be an advantage to the worker. The proper type of clothing depends on the specific circumstance. Certain work in hot environments may require insulated gloves, insulated suits, reflective clothing, or infrared reflecting face shields. For extremely hot conditions, thermally-conditioned clothing is available. One such garment carries a self-contained air conditioner in a backpack, while another is connected to a compressed air source which feeds cool air into the jacket or coveralls through a vortex tube. Another type of garment is a plastic jacket which has pockets that can be filled with dry ice or containers of ice.

Recommended Exposure Limits

These Threshold Limit Values (TLVS) refer to heat stress conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse health effects. The TLVs shown in Table I are based on the assumption that nearly all acclimatized, fully clothed workers with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 38 degrees Celsius (100.4 degrees Fahrenheit).

Since measurement of deep body temperature is impractical for monitoring the workers' heat load, the measurement of environmental factors is required which most nearly correlate with deep body temperature and other physiological responses to heat. At the present time, Wet Bulb Globe Temperature Index (WBGT) is the simplest and most suitable technique to measure the environmental factors. WBGT

values are calculated by the following equations:

Outdoors with solar load: WBGT = 0.7 NWB + 0.2 GT + 0.1 DB

Indoors or Outdoors with no solar load: WBGT = 0.7 NWB + 0.3 GT

```
Where:  WBGT = Wet Bulb Globe Temperature Index
        NWB = Natural Wet Bulb Temperature
        DB = Dry Bulb Temperature
        GT = Globe Temperature
```

The determination of WBGT requires the use of a black globe thermometer, a natural (static) wet-bulb thermometer, and a dry bulb thermometer.

Higher heat exposures that shown in Table I are permissible if the workers have been undergoing medical surveillance and it has been established that they are more tolerant at work in heat than the average worker. Workers should not be permitted to continue their work when their deep body temperature exceeds 38.0 degrees Celsius (100.4 degrees Fahrenheit).

Table 1
Permissible Heat Exposure Threshold Limit Values
(Values are given in degrees Centigrade WBGT (Fahrenheit)]

	Work Load		
Work- Rest Regimen	**Light**	**Moderate**	**Heavy**
Continuous work	30.0 (86.0)	26.7 (80.1)	25.0 (77.0)
75% Work, 25% Rest/Hour	30.6 (87.1)	28.0 (82.4)	25.9 (78.6)
50% Work, 50% Rest/Hour	31.4 (88.5)	29.4 (85.0)	27.9 (82.2)
25% Work, 75% Rest/Hour	32.2 (90.0)	31.1 (88.0)	30.0 (86.0)

References

1. "Working in Hot Environments," US Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, 1986.
2. "Threshold Limit Values and Biological Exposure Indices for 1986 - 1987," American Conference of Governmental Industrial, Hygienists, 6500 Glenway Avenue, Building D-7, Cincinnati, OH 45211-4438.

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APPENDIX C

DAILY TAILGATE MEETING FORM

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Daily Tailgate Meeting Form

Project Title:	Date/Time:
Site Location:	Muster Point:
AES Site Manager:	AES SSHO:
Work to be performed:	

Potential Safety and Health Hazards		
Hazard	Considerations	Comments
CRITICAL		
☐ Sub-surface work	☐ Utility location complete	
☐ Confined space entry	☐ Access and egress safe ☐ Retrieval device in place	
☐ Work over 6 ft	☐ Fall protection in place	
☐ Electrical/Mechanical Isolation	☐ Lockout/Tagout complete	
☐ Hot work	☐ Flame retardant clothing	
☐ Excavation entry	☐ Sloping, benching complete	
GENERAL		
☐ Slips/trips & falls	☐ Hazard areas acknowledged	
☐ Travel to and from site	☐ Load secured ☐ Vehicle in good working condition	
☐ Electrical	☐ GFCI/Power shut-off switch or breaker	
☐ Overhead hazards	☐ Power lines, loose items, pipelines, etc.	
☐ Power tools/hand tools	☐ Inspected & in good working condition ☐ Operator familiar with proper use	
☐ Heavy equipment	☐ Communication/eye contact w/ operator	
☐ Motor vehicles/traffic	☐ Signs/Cones/Barriers ☐ Reflective and/or bright colored clothing	
☐ Pinch Points	☐ Hand protection	
☐ Cuts/Abrasions	☐ First Aid Kit	
PHYSICAL		
☐ Adverse weather conditions	☐ Proper clothing available	
☐ Noise	☐ Hearing protection	
☐ Vibration	☐ Anti-vibration gloves	
☐ Hazardous atmospheres	☐ Atmospheric monitoring devices (i.e. PID)	
☐ Flam./explosive materials	☐ Correct storage/secure if transporting	
☐ Manual lifting	☐ Proper lifting techniques	
☐ Oxygen deficiency	☐ Monitoring device	
	CHEMICAL	
☐ Contaminants of concern	☐ Appropriate PPE ☐ Air monitoring as applicable	
☐ Hazardous materials	☐ Spill prevention measures in place ☐ MSDS readily available	
☐ Particulates (fibers/dust)	☐ Dust control measures	
☐ Pressurized lines (hydraulic)	☐ Spill prevention measures in place	
☐ Gases/Vapors	☐ Monitoring devices	

Daily Tailgate Meeting Form

BIOLOGICAL		
☐ Wildlife interaction	☐ Right of way to wildlife/avoid interaction ☐ Bear spray/fog horn	
☐ Insects	☐ Repellent	
☐ Plant interaction	☐ Avoid contact if possible	
☐ Sanitation	☐ Location of safe use	
☐ Travel over sensitive areas	☐ Minimize unnecessary impacts	

Hazard Controls - PPE		
☐ Hard hats	☐ Foot protection (i.e. steel toes)	☐ H2S monitor, PID, Multi-gas meter
☐ Safety glasses	☐ Hand (i.e anti-vibration, nitrile)	☐ Respirators or dust guard
☐ Hearing protection	☐ Flotation devices	☐ Fall protection
☐ Fire resistant clothing	☐ Slip Protection (ice grippers)	☐ Face Shields
☐ Reflective vest	☐ Other:	☐ Other:

Other considerations		
☐ Spill kit	☐ Means of communication	☐ Decontamination Procedures
☐ Fire extinguisher	☐ Ensure necessary permits are in place	☐
☐ Safe site access/egress	☐ Eating, drinking, smoking locations	
☐ First aid kit	☐ Proper waste disposal	

Emergency contacts:		
Police:	Ambulance:	Fire:
Nearest Medical Facility:		

I agree to work safe and to work smart:

	ATTENDEE:	SIGNATURE:	ORGANIZATION:
1			
2			
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10			

APPENDIX D

ACCIDENT INJURY, ILLNESS, AND INCIDENT REPORT

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Form SH 7-6

ACCIDENT / INJURY / ILLNESS / INCIDENT REPORT

The attached Report of Accident must be completed and forwarded to the AGSC Corporate Office ***within 24 hours*** *of a reported accident, injury, illness, near-miss or related incident (to include motor vehicle accident (MVA), environmental release or threatened release, regulatory inspection and/or notice of violation).*

Check one
Initial Report: ☐
Update: ☐
Final Report: ☐

INCIDENT ANALYSIS REPORT

Section 1 – Incident Type (mark all that apply)

☐ Near Miss ☐ First-aid Case ☐ Medical Treatment ☐ Hospitalization Required
☐ Fatality ☐ Day Away Case ☐ Restricted/Transfer Case ☐ Environmental Release
☐ Regulatory Inspection ☐ Notice of Violation ☐ Other (please describe): _____

Section 2 – General Information

Local Office ID: _____ Date of Incident: _____ Military Time: _____ Day of Week: _____

Report Date: _____ Date injury/illness reported to employer: _____

If date reported is not date of injury/illness or medical treatment sought at a later date, explain:

Ahtna Supervisor on Duty: _____

Ahtna supervisor at the Scene of Incident: _____

Location where incident occurred: _____

Is this a Company controlled work site: ☐ Yes ☐ No

Section 3 – Affected Employee Information (Include injured person, driver/operator, or employee whose activities resulted in the incident. Use another page to provide information for additional employees)

Employees Full Name: _____ Sex: ☐ M ☐ F Date of Birth:_____

Employees Home Address: _____ Ahtna Employee: Yes ☐ No ☐

Job Title: _____ Hire Date: _____

Department:_____ Project Manager: _____ Client: _____

Office where employee works from: _____ Immediate Supervisor: _____

Time employee began work: _____ Hrs. employee worked during last 7 days: _____

Section 4 – Injury/Illness Information

If an **injury or illness** - describe the part of the body that was affected and how it was affected:

First Aid Provided: ☐ Yes ☐ No If Yes: On-site ☐ Off-site ☐ Who Provided First Aid: _____

Was employee treated by a physician or in Emergency Room? ☐ Yes ☐ No

If Yes, was medical treatment provided: On-site ☐ Doctors Office ☐ Hospital ER ☐ _____

Name or Person(s) providing treatment: _____

Address where treatment was provided (include hospital name if applicable): _____

Was employee hospitalized overnight as an in-patient? ☐ Yes ☐ No

Last day employee worked: _____ Date employee returned to work: _____

If injury/illness resulted in death, what is the date of death? _____

Section 5 – Incident Description (Attach and number additional pages, as needed, to ensure all details related to incident captured.)

A. NATURE of INJURY

SPECIFIC INJURY/ILLNESS and PART of BODY AFFECTED, MEDICAL DIAGNOSIS if available (e.g. Second degree burns on right arm, tendonitis on left elbow, lead poisoning) .

B. LOCATION

B (1): LOCATION WHERE EVENT or EXPOSURE OCCURRED (Number, Street, City, Zip)

B (2): DEPARTMENT / FUNCTIONAL UNIT WHERE EVENT or EXPOSURE OCCURRED (e.g.. Office, Environmental, Construction, SLD). Identify :

B (3): IS this an AHTNA CONTROLLED JOBSITE? YES ☐ NO ☐

B (4): OTHER WORKERS INJURIED or ILL in the EVENT? YES ☐ NO ☐

C. SOURCE of INJURY

C (1): EQUIPMENT, MATERIALS and CHEMICALS the EMPLOYEE WAS USING WHEN EVENT or EXPOSURE OCCURRED (e.g.. welding torch, hand tool, heavy equipment, scaffold)

C (2): WHAT OBJECT or SUBSTANCE DIRECTLY HARMED the EMPLOYEE?

D. WHAT HAPPENED?

D (1): SPECIFIC ACTIVITY the EMPLOYEE was PERFORMING WHEN EVENT or EXPOSURE OCCURRED (e.g. welding seams of metal forms, loading boxes onto truck, cutting materials).

D (2): What was the EMPLOYEE(s) DOING JUST PRIOR to the INCIDENT?

E. HOW INCIDENT HAPPENED / SEQUENCE OF EVENTS

HOW INJURY/ILLNESS OCCURRED. DESCRIBE SEQUENCE of EVENTS. SPECIFY OBJECT or EXPOSURE WHICH DIRECTLY PRODUCED the INJURYIILLNESS, e.g.. Worker stepped back to inspect work and slipped on scrap material. As he fell, he brushed against fresh weld, and burned right hand. USE SEPARATE SHEET IF NECESSARY

F. EQUIPMENT DAMAGE

F (1): LIST any DAMAGED EQUIPMENT or PROPERTY (other than motor vehicles), MODEL and SERIAL NUMBER and ESTIMATED VALUE. List the names of any witnesses, their employer, and a local/company telephone number or address:

G. WITNESSES / OTHERS INVOLVED IN INCIDENT

G (1): LIST the NAMES of ALL PERSONS INVOLVED in the INCIDENT, EMPLOYER and CONTACT INFORMATION:

G (2): LIST the NAMES of any WITNESSES, their EMPLOYER, and CONTACT INFORMATION (e.g. phone number, address):

Section 6 - Incident Analysis

A. Was a Job (Activity) Hazard Analysis (JHA/AHA) completed for the work being performed? YES ☐ NO ☐ Who prepared the JHA?

Explain:

B. When and who was the last safety officer (i.e. LSHC, supervisor, ES&H Manager, etc.) at your work site?

Explain:

C. Did the person **directly related** to the incident have site specific safety training, and when? (specify topics covered)

Identify Training:

Section 7 - Incident Investigation Results

#	**Causal Factors** (*Any behavior, condition, act, or omission that starts or sustains an accident occurrence. Avoiding or eliminating would prevent the occurrence. Examples: taking shortcuts, operating equipment at unsafe speed, not following established work practices, inadequate training, inadequate procedures, and equipment/material failure.*) (Attach and number any additional pages, as needed, to completely address this section.)
1	
2	
3	
4	

Root Cause(s) Analysis (The items below represent major root cause categories which have been determined to be Less Than Adequate (LTA). A more detailed determination of the root cause will be facilitated, if needed, by your ES&H Manager.)

1. Equipment Reliability Program Implementation
2. Administrative / Management Systems
3. Immediate Supervision
4. Training
5. Human Factors Engineering (Ergonomics)
6. Communications
7. Personal Performance

Root Cause #	**Corrective Actions to be taken** (Attach additional pages, as needed, to completely address this section)	**Responsible Person**	**Proposed Completion Date**	**Closed on Date**	**Verified by and Date Verified**

Section 8 – Signatures / Approvals - *Note: SH&E Mgr to Copy CEO on OSHA recordable incidents.* Date Sent

Incident investigated / reviewed by (signatures):			
		Local S&H Coordinator:	Date:
Employee's Supervisor:	Date:	SH&E Manager:	Date:
Project Manager:	Date:	Work Comp Administrator:	Date:

Add any additional Comments in this Section:

VEHICLE INCIDENT REPORT

Section 1 - General Information

Time incident occurred: _____ ☐ AM ☐ PM | ☐ Dark ☐ Light | Road Condition: ☐ Dry ☐ Wet | Date of Incident: _____

Were police summoned to scene? ☐ Yes ☐ No Police Department and Location: _____

Report #: _____ Officer's Name and Badge Number: _____

Section 2 - Company Driver and Vehicle

Driver's Name: _____ D/L # _____ State _____

Driver's home office address: _____ Driver's Phone # _____

Company Vehicle # _____ Year _____ Model _____ License # _____ State _____

Company car? ☐ Yes ☐ No Owned by employee? ☐ Yes ☐ No

Leased/Rented from _____

Passenger/Witness Name(s) _____ Address: _____ Phone: _____

Passenger/Witness Name(s) _____ Address: _____ Phone: _____

Passenger/Witness Name(s) _____ Address: _____ Phone: _____

Damage to vehicle (identify and attach photos): _____

Injuries to employee(s): _____

Injuries to others: _____

Vehicle was being used for: Company business ☐ Yes ☐ No Personal business ☐ Yes ☐ No

Towed: ☐ Yes ☐ No By Whom: _____ To Where: _____

Section 3 - Other Driver and Vehicle Information

Driver's Name: _____ D/L # _____ State _____

Driver's home office address: _____ Driver's Phone # _____

Telephone: Home _____ Work _____ Cell _____

Reg. Owner's Name: _____ Address _____ City _____ State _____
(verify registration document)

Other Vehicle: Make _____ Model _____ Year _____ License # _____ State _____

Insurance company name: _____ Address _____ Phone _____

Policy No. _____ Contact Person _____ Phone

Passenger/Witness Name(s) _____ Address: _____ Phone: _____

Passenger/Witness Name(s) _____ Address: _____ Phone: _____

Injuries to other driver/passengers [Identify person(s), comments, extent of injuries as known]:

_

Damage: (*Make a sketch of incident scene, with street names. Note pre-existing damage and take pictures if possible.* ***Attach more pages as needed****)*

	Indicate the vehicles involved and direction of travel using the following symbols (i.e. → = Direction) V1 **Vehicle 1 (your vehicle)** V2 **Vehicle 2 (other vehicle)** → = East ↑= North  = Pedestrian (draw stick figure)

Section 4 – Approvals (signatures required)

Incident investigated / reviewed by (signatures):	
Employee(s): Date:	Local S&H Coordinator: Date:
Employee's Supervisor: Date:	ES&H Manager: Date:
Project Manager: Date:	ES&H Manager sends a copy to CEO for injury incidents and/or accidents resulting in damages that exceed $1,000. Date Sent:

Things to Do First in the Event of a Motor Vehicle Incident

1. Most important: **STOP.**
2. **Call 911 if there are injuries.**
3. Call for an officer if the incident occurred on public property (streets, highways or roads). Disputes often arise between the parties involved as to who was at fault; therefore, a police report is important. If an officer is unable to attend the scene of the accident, a counter police report may be filed at most stations. Insurance companies rely on police reports to determine liability.
4. Complete the Incident Investigation Report and the Vehicle Incident Report forms. It is important that both these forms are completed in detail. Include a diagram of the incident on the back of the report. Incomplete information may lead to delays in processing associated claims and in preventing this type of incident from occurring again.
5. Express no opinion as to who was at fault. This is for the insurance companies to determine.
6. Give only information that is required by the authorities or as directed by AHTNA contractual requirements.
7. Sign only those statements required by the authorities or as directed by AHTNA contractual requirements. Do not sign away your rights or the company's rights.
8. If you are injured or think you were injured, tell your supervisor and see a physician. Your supervisor will notify AHTNA's Worker's Compensation insurance carrier, your ES&H Manager and the Corporate Director of ES&H by phone, email or fax. For additional instructions on what to do, contact AHTNA's ES&H office at (916) 372-2000.
9. Your supervisor will forward both completed incident reports immediately to **y**our ES&H Manager.